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ELECTRICAL MEASUREMENT OF WATER-WHEEL SPEEDS.

The value of electrical methods in the field of precision measurements increases each year. Outside the laboratory there are now many applications of electricity in refined commercial measurements requiring high accuracy in results, and the list of these is constantly growing longer. One of the most recent uses of electricity for close measurement in the power plant was described by Mr. H. E. Warren at a late meeting of the Society of Arts in the Massachusetts Institute of Technology, in a paper upon the "Speed Regulation of High Head Water-Wheels."

Impulse wheels of the best modern type for heads of several hundred feet are now provided with combination deflecting nozzles with needle valves, the governors being designed to control the deflection and some other means provided to produce slow movements of the needle valves. Ordinarily with this arrangement the needle valve which regulates the cross-section of the jet is adjusted from time to time by hand as the load varies, so so that the governor, in order to maintain constant speed is obliged, most of the time, to direct the stream almost, but not quite, squarely against the moving buckets. When the load increases so that the portion of the stream which is held in reserve by the governor is inadequate to maintain the speed during sudden peaks in the load, the cross-section of the jet is increased either by an attendant or by a small electric motor mounted on the nozzle so that it may move the needle valve in or out very slowly, avoiding the severe strains on the life line which would result from the sudden cutting down of the high pressure stream. Control contacts for the motor are arranged to start it in the proper direction whenever the governor deflects the nozzle away from a predetermined position. This method is much superior to hand control, and it is as safe, for the fastest travel which the motor can give to the needle valve will not create water hammer.

To determine whether the speed regulation meets the guarantees of the governor manufacturer has long been a difficult problem. Ordinary tachometers can not be depended upon at all unless they have been carefully calibrated, and even then most of them have defects which make accurate determinations impossible. Frequency indicators are generally correct for the number of cycles where they are indicated to be used, but can not usually be depended upon over any range of scale. Mr. Warren has devised a method of using the oscillograph to obtain instantaneous measurements of load voltage and speed which is entirely free from instrumental defects, and which will give

results of great value in any power plant where there are two or more independent alternating-current units. The method consists in superimposing several current wave curves upon the oscillograph film, one of the curves being known to pass through a constant number of cycles per second. The constant curve is adopted as the standard unit of time, and its waves, as shown on the film, are used to measure the number of cycles per second of the other curve, and consequently the speed variations of the machine under test.

The measurement of the comparative frequency of the two curves is effected by allowing them to overlap on the film, producing beautiful interference effects. The interferences are due to the fact that at times the trace of both curves overlap on the film so as to produce a single line; while at other times, one curve having gained a part of a cycle over the other, the two lines will be side by side and more or less confused. When the speed of motion of the film is right, the negative shows alternate shaded bands, the distance apart of which when counted in cycles, is an accurate measure of the relative speeds of the two generators being compared; and if one of the generators is running at constant speed, it gives an absolutely clear record of the smallest variations in the speed of the other machine. Inertia, sluggishness, friction, faulty calibration and other objectionable features of mechanical devices are wholly eliminated, the only necessary condition being constant speed on the part of the generator used to give the standard line wave. The latter point can be insured by giving the generator either a perfectly steady load or no load at all, except the trivial current required by the oscillograph. It is necessary to disconnect the gate of this turbine from its governor and fix it in position, maintaining the water pressure upon the wheel very nearly constant and running the generator fifteen or twenty minutes before the measurements are made. Even though the graduations of a frequency indicator may be far from correct; it will serve the purpose of observing the speed of this generator, for steady speed is the only point desired. The inertia of the revolving parts of the turbine and generator in the absence of any external load maintains the speed with remarkable uniformity, and there is no difficulty in keeping the standard machine steady within 0.1 per cent, adjusting the frequency five or six per cent below or above that of the machine to be measured. If the standard machine runs five per cent in speed below the frequency of the machine under test, the fast machine will gain five cycles over the standard in 100 cycles, the interference points being twenty cycles apart. If the loaded machine gains five per cent above its normal speed, it would then be ten per cent faster than the standard one, thus gaining ten cycles in each 100, the interference bands being spaced at ten-cycle intervals.

The extreme precision of the method is shown in the large variation in the spacing of these interference bands, corresponding to comparatively small variations in relative speed. The voltage is also recorded, for the amplitude of the oscillograph curve depends precisely upon the voltage of the machine being tested. By using a third oscillograph mirror simultaneous measurements of the current output from the loaded machine may be secured, which means practically the variations in load. By connecting the third mirror with a current transformer in series with the generator under test, the author finds that the amplitude of the curve traced by the light reflected from the mirror indicates at every point on the sensitive film the exact current output of the generator corresponding to the speed and voltage of the other two curves. The oscillograph method makes it possible to conduct a speed test of any alternating-current unit, whether driven by a steam engine, turbine or water-wheel, under actual load conditions, being much more accurate than any test under special conditions which are never exactly the same as when in service.

REGENERATION OF POWER IN ELECTRIC RAILWAYS.

An interesting and suggestive paper on "The Regeneration of Power for Single-Phase Electric Railway Motors," was read at the recent convention of the American Institute of Electrical Engineers, by Mr. William Cooper. In this the author points out the conditions necessary to restore power from a moving car to the line. These are that the pressure generated by the motors must be greater than that of the line, and this pressure must be under control. There must, of course, be some power-consuming device on the line to take care of the power thus produced. He then shows that the single-phase motor has characteristics which make it possible to meet these conditions. To obtain complete control of the system, a constant-potential characteristic of the motors operating as generators is desirable, and the motors must, of course, be able to run successfully as generators when the relations between field and armature currents are not those which would obtain if they were operating as motors. In other words, it may be necessary for the armature current to be different from that in the field coils, and the commutating conditions will therefore not be those which would exist if the machine were running as a motor. Commutation under these conditions must for this reason be provided for, if successful regeneration is to be obtained.

The single-phase motor, as is pointed out, has a compensating winding which takes care of commutation, and the constant-potential characteristic is obtained by separately exciting the motors, which may be done by reserving one motor of the equipment as an exciter, or by providing some independent source of excitation. Control of the potential generated by the equipment is obtained easily by means of a regulating transformer. The system as described is simple in method and operates successfully.

An interesting point brought out is that the greatest advantage expected of a system of regeneration is not in the saving in coal, although it is believed that this will be from ten to twenty per cent of the total power under ordinary conditions; but it lies in the great saving in the wear and tear of the equipment. The retardation is secured by magnetic forces, and not friction of rubbing metals. There need be no actual wear. The usual braking system will therefore be held in reserve for emer-

gencies or for holding the train when standing. There will be little or no wear of brake-shoes or wheels or other auxiliary parts.

Regeneration has received little attention in this country. In Europe it has been used both with the three-phase system and with a special direct-current motor run as a shunt machine. It is now shown to be easily secured by means of the newer types of motor; therefore it is reasonable to expect that it will come into wider use. It is interesting to emphasize the point that the most desirable features of the regenerative system are not those at first assumed. This is frequently found to be the case with electrical systems, which are often introduced for reasons entirely different from those which led to their devising.

THE WIRELESS CONTROL OF MECHANISMS.

Ever since wireless telegraphy was shown to be at all practicable, it has been the aim of inventors to devise means for using this method of transmitting energy to control mechanisms at a distance. There are a good many occasions when such a system would be of considerable benefit; for example, the controlling of lights used for marine signals at points where it is not practicable to maintain an attendant. Another very obvious application would be in the control of machines employed for war purposes, such as torpedo boats, mines and other offensive and defensive appliances.

At first thought it would seem a somewhat difficult matter to obtain, by means of a wireless system, anything more than the most elementary control, and the inventor would be forced to confine himself to the control of a single action. Fortunately, this is not so, as is clearly demonstrated by the description, by C. L. Durand, of the system devised by Dr. Edouard Branly, which appears on another page of this issue. It will be seen from this that Dr. Branly makes it possible to control any desired number of actions. It will be seen also that this control is not perfect, because it is possible to control but one action at a time, and this only at stated intervals.

The method by which this is accomplished consists in driving two series of distributing switches in synchronism, one at the control station and the other at the station where the controlled mechanisms are. That at the receiving station closes one after the other of the circuits controlling the different actions of the station. During this period it is possible, by sending an electrical wave from the control station, to close a delicate relay in that particular circuit, which, in turn, closes the circuit of the local controlling mechanism, and thus effects the desired operation—the firing of a mine, the discharging of a torpedo, or the steering of a boat. An important feature of the system, and one which is almost indispensable, is the automatic return signal given when the mechanism has completed the operation desired. Were this not done, it would be impossible for the operator to tell whether his attempt to control had been successful or not, and he would thus lose track of what was going on at the receiving station.

This system is very ingenious, without being excessively complicated. As said before, however, the control is not perfect, for while it is possible to carry out any action desired, this can not be done when desired, but only at stated intervals, although these may be but a fraction of a minute apart. Moreover, it is possible to control but one action at a time. A rather serious disadvantage would seem to be the possibility of interference with the action of the system by the enemy when it is employed for combat. It seems probable that if an approaching vessel had reason to suspect the presence of such a device, that by sending out continuously a torrent of electrical waves, these would completely upset the control of the system and render the device useless. Even were the system accurately tuned, by determining the frequency of the controlling signals it would be possible to upset the action of the system. Even for use in times of peace, there is a possibility that, unintentionally, wireless telegraph stations may interfere with the operation of such a system, unless the latter respond only to electrical signals of widely different frequency from those generally employed for telegraphing.

REPORT ON MUNICIPAL OWNERSHIP.

On another page are published brief abstracts of a number of reports prepared by the Municipal Ownership Commission of the National Civic Federation. These are most interesting reading, and throw a good deal of light upon this much-discussed question; but it seems hardly probable that the method of preparing these reports will do much towards settling the question definitely. Each report, or rather each subject, is discussed by a committee consisting of members in favor of and opposed to municipal ownership, and in general these two factions submit independent reports. The reader can therefore get any information he desires if only he select the proper report; and as the general public will see only those brief extracts from the reports which get into the public press, so far as it is concerned, the investigation of this commission is hardly likely to carry much weight.

It must be said, however, that this commission has done very valuable work, and the method of doing this insures that all sides of the question are represented. What should be done now is to have a digest of these reports, prepared by an impartial committee which is competent to weigh all the evidence presented and from it come to some conclusion. Unfortunately, this is too much to hope for, but it is not too much to expect that all those taking any active part in the discussion of this important question should study the reports secured through the efforts of the National Civic Federation and study them fairly, not merely seeking in them evidence to bolster up their own sides of the discussion. But, unfortunately, any question which acquires political significance is little likely to be considered on its merits only.

CONVENTION OF THE ILLUMINATING ENGINEERING SOCIETY.

The first annual convention of the Illuminating Engineering Society will be held in Boston on Tuesday and Thursday of next week. Every indication points to a most successful meeting. The programme for this convention is given elsewhere in this issue.

Illuminating Engineering Society.

The preliminary programme of the convention of the Illuminating Engineering Society, which will be held in Boston, July 30 and 31, has been announced. The headquarters for registration in advance of the meeting will be at Room 728, Old South Building, 294 Washington street. The meetings will be held in the convention hall of the new Edison Building, 39 Boylston street. Due to the large number of papers to be considered, the convention will be opened at 9.30 sharp, Tuesday morning, July 30. Advance copies of the papers will be ready for the delegates at the place of meeting, and provisions will also be made for registration there, and for giving general information.

Wednesday afternoon, it is planned to take the entire convention to the beach, where there will be a shore dinner for the members and guests. It is suggested that some members may desire to witness the electrical parade and carnival, which will take place in Boston on Monday evening, July 29. They should reach that city some time Monday afternoon. The convention is being held during Old Home Week and the city will be decorated and illuminated profusely.

The following is the list of papers which has been promised:

President's address, Dr. C. H. Sharp.

"Check on Reliability of Photometric Curves," J. S. Codman.

"Electric Light as Related to Architecture," C. Howard Walker.

"Acetylene," A. Cressy Morrison.

"What is Street Lighting?" W. H. Blood, Jr.

"A New Comparison Photometer," Dr. Charles H. Williams.

"Primary, Secondary and Working Standards of Light," Dr. Edward P. Hyde.

"The Inverted Gas Light," T. J. Litle.

"The Lighting of the Boston Edison Building," Dr. Louis Bell, L. B. Marks, and W. D'A. Ryan.

"Illuminating Engineering and Central Station Practice," L. H. Scherck.

"New Lights and New Illuminants from the Central Station's Point of View," R. S. Hale.

"Coefficients of Diffuse Reflection," Dr. Louis Bell.

"School House Illumination," B. B. Hatch.

"Illumination of the Engineering Societies Building, New York," C. E. Knox.

"The Elements of Inefficiency in Diffused Lighting Systems," Preston S. Millar.

"Illumination Photometers and Their Use," Preston S. Millar.

"The Present Status of Candle-Power Standard for Gas," C. H. Stone.

"The Luminous Arc," W. D'A. Ryan.

"Acetylene Lighting," Nelson Goodyear.

This list, it will be seen, covers a wide range of topics, and will lay before the members the results of a large amount of original research. Other papers are expected.

Arrangements are being made for a party of delegates to leave New York by the Providence line, from Pier 18, North River, New York city, at 6 P. M., Monday, July 29. Dinner will be served on board, *a la carte*. The fare for the round trip from New York will be $5.65. Staterooms may be reserved by communicating with E. S. Peters, ticket agent, Pier 19, New York, or by writing Preston S. Millar, secretary of the New York section, Eightieth street and East End avenue, New York city. Requests for reservation must be accompanied by a sum sufficient to pay for the stateroom. Prices range from $1 to $10 per stateroom. A satisfactory outside stateroom may be secured for $2. Any further information may be obtained by writing the chairman of the convention committee, John Campbell, 729 Old South Building, Boston, Mass.

Legislation Providing for the Development of the Water Power of New York State.

Governor Charles E. Hughes, of New York state, has signed the bill introduced by Senator Fuller, carrying out the governor's idea for protecting the state's water powers. This bill gives the state Water Supply Commission a special appropriation of $35,000, and directs it to devise a plan at once for the progressive development of the water power of the state, under state ownership, controlled and maintained for the public use. The commission shall proceed at once to collect information relating to the water powers of the state, and shall devise plans of development of such water powers as it deems advisable, and may devise plans for the development of such other water power as shall be brought to its attention by the mayor of any city, the president of any village, the supervisor of any town, or the chairman of the board of supervisors of any county. The commission is called upon to present a report to the governor on or before February 1, 1908, showing the progress made in its investigations, and shall, if practical, complete its own investigations to such an extent as will enable it to devise a comprehensible and practical plan for the general development of the water power of the state, and make the final report of such plan to the governor on or before February 1, 1909.

If any plan be devised by the commission, full particulars of the work and of the power to be developed must be given. The probability of selling this power, and the probable gross and net revenue, must also be estimated.

The state is to issue bonds to develop these powers, and they are to be paid for by state revenue secured from the sale of electrical energy.

Brooklyn Edison Contract Department Entertains.

On Monday, July 8, at 6.30 P. M., at the Brighton Beach Hotel, the contract department of the Edison Electric Illuminating Company of Brooklyn had as guests at dinner W. W. Freeman, W. F. Wells, P. A. Atkinson and J. F. Becker, Jr., the vice-president, general superintendent, treasurer, and general agent of the company. In no other concern in this country does a greater amount of respect and good-fellowship exist between officers, heads of departments and the men.

On Monday night the officers vied with the men in paying compliments and the determination of all was that this year's business should beat the almost unprecedented record of 1906.

J. F. Becker, the able and genial contract chief, acted as toastmaster. Toasts were responded to briefly by some six or eight of the diners, after which W. W. Freeman through his thoughtfulness and generosity made it possible that this dinner become an annual affair.

After the banquet the vaudeville at the Brighton Beach Music Hall was thoroughly enjoyed by all.

Vermont & New Hampshire Independent Telephone Association.

About sixty members of the Vermont & New Hampshire Independent Telephone Association held their fifth semi-annual meeting at Bradford, July 9 and 10.

A proposition was submitted that the independent companies combine for the construction of trunk lines and this was approved.

A paper on the growth of the independent movement last year was read and a strong address was made on the need of looking after the independent interests in the legislatures of Vermont and New Hampshire.

The Branly "Telemechanic" System.

By C. L. Durand.

A new system of operating mechanical devices from a distant point, known as "telemechanic," has been brought out by the eminent French scientist Professor Branly, whose work in radio-telegraphy is too well known to need further mention. Waves sent from the operating station act upon a coherer and a set of suitable apparatus placed at a distant point, causing various mechanical effects to take place, and these are quite under the control of the operator.

The present system comprises a wave-producer at the sending station, and at the receiving end is a coherer and relay, a distributing device for operating the different apparatus under control, and an indicating or check apparatus which sends signals automatically to the operator.

The form of coherer used in the present experiments is the tripod coherer invented by Professor Branly. The coherer is simpler and is claimed to be more sensitive than the filings-tube form. It is also more rapid in its action. The metal tripod T (Fig. 1) has a set of points of tempered steel well polished, or else cobalt can be used, also having a highly polished surface. The tripod rests upon a tempered steel disc D, which also receives a high polish on the upper surface. Current from a battery comes by way of the binding post P, then goes to the disc D, and thence to the tripod T by the points *a*. Thence it goes to a screw V which presses against a platinum piece *o*. A flexible wire *f* leads from thence to the second binding-post P'. When the spark is made at the sending post, the circuit is closed at the contact of the points *a* and the steel disc. Fig. 1 shows the coherer mounted upon a Morse receiver according to Professor Branly's method. When the electromagnet of the receiver attracts the armature (by means of a relay) this causes the coherer circuit to be broken at the point *o*. An independent striker for the coherer is not used, but the end *d* of the armature lever strikes against the end of the screw *b*. This shock is sufficient to restore the coherer, and it occurs automatically at the end of every signal.

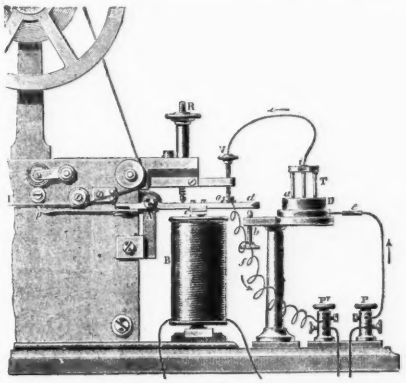


Fig. 1.—Coherer and Connections.

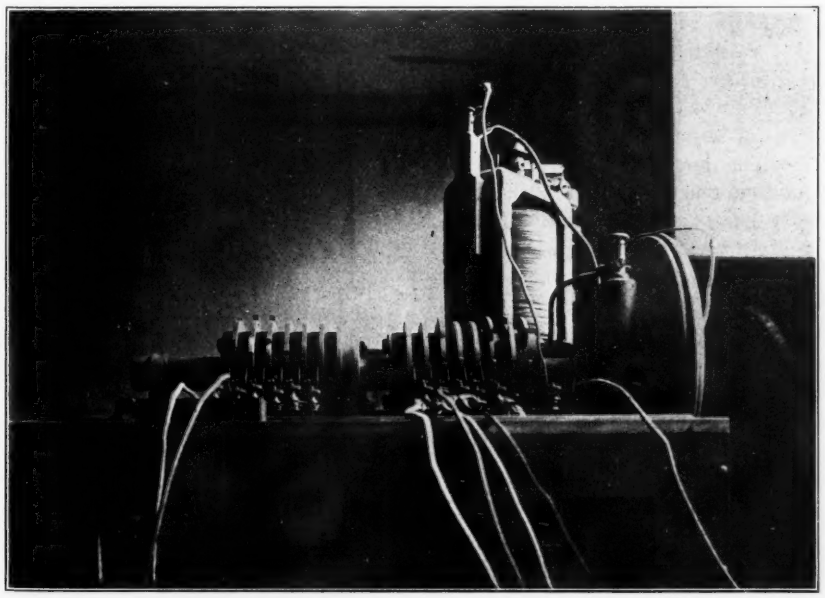


Fig. 2.—Detail View of Distributor.

The essential part of the operating mechanism (Fig. 2) consists of a rotating shaft which carries a number of discs insulated from each other, forming what is known as the distributing shaft. Each one of the discs operates the opening or closing of a circuit which is used for a special case, such as lighting lamps, for instance. To carry this out, the circumference of the disc is enlarged by a sector which comes in contact with a spring, and this makes the circuit for a fraction of a revolution, allowing the current to pass in a local circuit so as to operate the appropriate device which is controlled by the disc, or again to interrupt this action. Taking the case of lighting incandescent lamps, the disc closes for eight seconds a circuit including a battery and the coherer above described. During this time a spark may be produced in the sending station. If so, the waves act upon the coherer and cause the lamps to be lighted by an electromagnetic switch. After one or any number of revolutions of the distributing shafts, the lamps can be turned off provided a second spark is sent during the time in which the disc is in the active position. It is understood that the electromagnetic device for opening and closing the lamp circuit is arranged so as to operate properly by such action. During the interval which is devoted to operating the lamp device, no other effect can take place, seeing that the other discs of the series are in the off-position during this time. After the lamp-operating disc has rotated for the given time, it comes into the off-position, as its sector leaves the contact spring. A second disc then begins to make contact, and at this time a new circuit can be closed through the coherer, for operating a second device.

Each element of the device thus consists of a disc for closing the circuit, the coherer and its relay, a second relay for heavy current and a strong solenoid which gives a mechanical action. The disc first makes the given contact, then the coherer acts by the distant spark and operates its sensitive relay. This relay sends a local current into the lamp-operating relay, and the latter in turn sends a heavy current into the solenoid of the electromagnetic

switch which turns on the lamp circuit. Where electric lighting mains are at hand, the latter current can not be used to advantage in the heavy solenoids which are needed to give a mechanical effect.

One of the ingenious features of Professor Branly's system lies in the method which is used for checking up the results which are produced and allowing the operator in the distant station to keep account of the working of the apparatus which he controls. In fact he is notified as to the moment when he can produce a determined effect, and this is done by means of a radio-telegram which he receives and which is registered upon the paper strip of a Morse receiver. The signals upon the strip are made by a spark apparatus in the distant station,

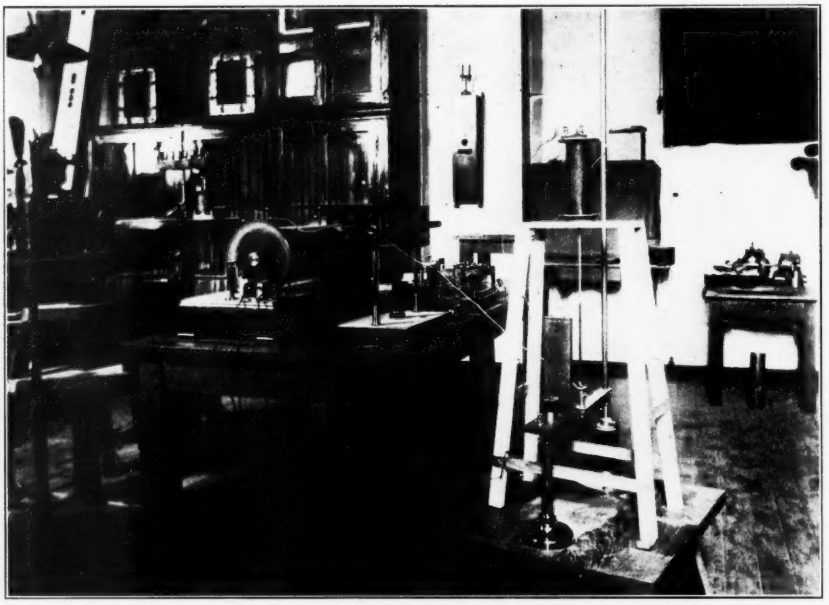


FIG. 3.—AUTOMATIC TELEGRAPH.

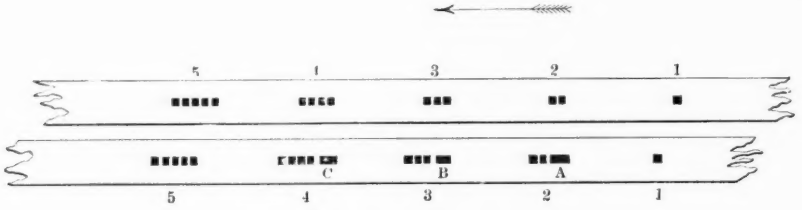


FIG. 4.—RECORDING SIGNAL STRIP.

which work automatically in connection with the distributor above mentioned. The "automatic telegraph" (Fig. 3), as it is called, is operated by a special disc placed on the distributor along with the others. It is provided with five sets of teeth, and the contact made by these teeth with a spring bearing upon them causes five separate sets of sparks to be formed at each revolution of the disc, and the groups of sparks are separated by equal intervals. Each of these intervals corresponds to a length of about four inches of strip unrolled from the Morse register at the sending end.

Upon this strip there is registered by a coherer, in the usual way, all the sparks which may be sent from an apparatus placed at the receiving end. Thus, when the above-mentioned disc makes a revolution and sends the five groups of sparks, these are registered upon the strip (Fig. 4) at the sending post. In practice, the spark-disc sends at each revolution a set of signals which are shown here, independent of any movement being made at the sending post. The five groups consist of from one to five dots on the paper, corresponding to the number of teeth on the spark-disc. In this way the operator can observe the relative position of the spark-disc upon the shaft, and seeing that it is mounted fixed with reference to the other discs of the series, he also sees the position of the latter. Disc No. 1, or the lamp-disc, for instance, mounted so that its contact is being made between the first and second position of the spark-disc, that is, between signal 1 and signal 2. This interval is therefore reserved for the operation of the disc, as it remains active between signal 1 and signal 2. Between signal 2 and signal 3, disc 1 is now in the off-position and disc 2 is now active, and so on for all the discs in the series. All the circuits are open during the short fraction of a revolution when the spark-disc is sending the signals. In the intervals between the signals, the operator, who is observing the strip as it unrolls, can now make a spark with his sending key and cause an action at the other post. The space from 5 to 1 is devoted to the electric motor which operates the distributor. A special relay is used at the receiving post for throwing the electric motor of the distributor on or off. This relay acts in the same way as the others, and is controlled in the interval between 5 and 1. Needless to say, the number of such spaces or movements can be greatly increased by placing the proper number of discs upon the distributor. The sector of each disc will then be made shorter in proportion.

The same coherer and sensitive relay are used for all the circuits in question.

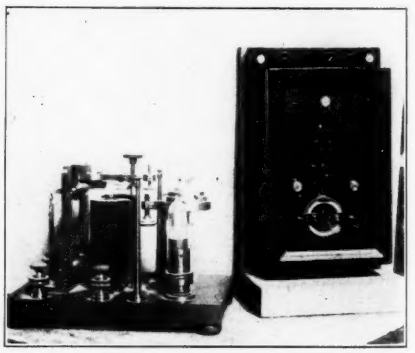


FIG. 5.—COHERER AND RELAY.

They are enclosed in a metal case covered on the sides with wire gauze, and the box serves as a support for the distributor. At the sending post, the Morse register with its coherer mounted as shown in Fig. 1 and Fig. 5, is also protected by a metal case from the influence of the sparks which the operator forms. Each post has but a single mast, which serves two purposes. At the receiving post, the mast which is used for the automatic telegraph becomes the receiving mast for the operating devices when the discs come into the active position, and at the sending station the mast which is used for the operating sparks serves to receive the signals sent from the other part of the automatic telegraph. It is understood that as

all the actions are automatic in the receiving post, there need be no operator at this point. Such is the case for instance where such a post is installed within a torpedo boat. Here the separate discs

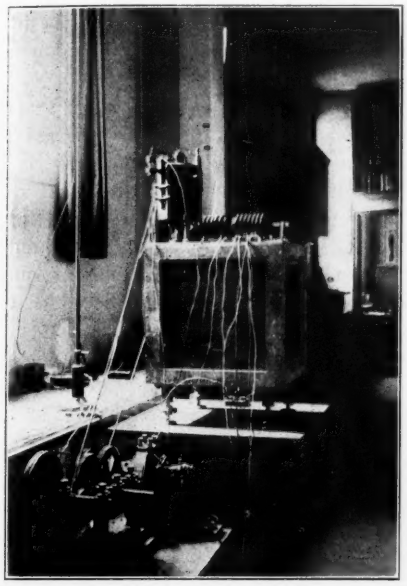


FIG. 6.—DISTRIBUTOR AND MOTOR.

control different angles for the rudder so as to steer the torpedo boat, also different speeds of the propeller, the start, stop, reverse, signal lights, torpedo launching, and all other movements, and as we have

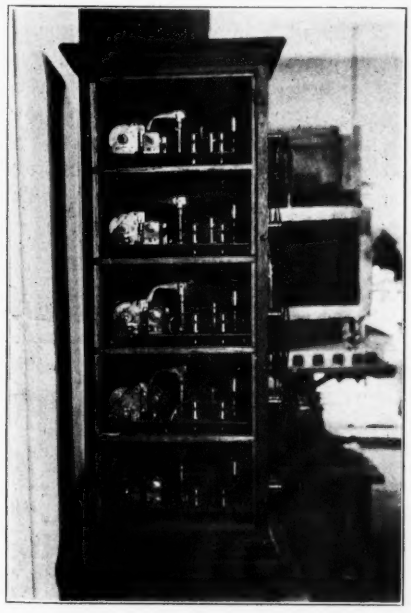


FIG. 7.—WORKING RELAYS FOR DIFFERENT CIRCUITS.

seen, the operator on shore knows just when to press his key for controlling all the movements.

It is also quite important for the operator to know whether the different devices have responded perfectly or not, so as to be sure of what he is doing. This he is able to observe by means of the "control signals," which are sent from the other post. To carry this out, the distributor carries a second set of discs somewhat like the first, but each one carries a single contact tooth. A control disc is allotted to each operating circuit. One of these discs closes the circuit of the automatic telegraph once in each revolution of the shaft. The closing of the circuit can only take place, however, should the solenoid switch or other device have operated properly, and this is easily carried out by means of a contact device placed upon such switch, etc. Each control spark is observed at the sending end by a dash upon the paper strip (Fig. 4) which precedes the other signals already mentioned, as will be noticed. Such signals may or may not occur upon the strip, while the sets of dots always occur. Starting from 1 to 2, the operator presses his key as soon as he sees signal 1. The lamps are then lighted. At the end of this action, the control disc works the automatic telegraph and sends dash A, this occurring at the end of the interval. Dash B is sent in like manner at the end of the second space, and so on. But should the lamp device have failed to operate, the circuit would not have been closed at the automatic telegraph and the dash would be absent, showing at once that the effect had not taken place. The operator would wait therefore for another revolution of the disc, and would see where the fault lay. In this way, when one effect depends upon the preceding one, he will not make a false maneuver.

To give an idea of the practical operation of the above system, that of lighting and extinguishing the lamp of a lighthouse may be taken, dividing the time into three different parts. Start—8 P. M.: the operator sends the first spark from the station; the motor at the other post commences to rotate the distributor; during the rotation, the sparks from the automatic telegraph keep on registering on the paper-band as shown in the first series; in the intervals between these, the operator sends sparks which operate different devices, such as the lighting of the lamp, working of the revolving device, etc.; these operations are carried out in their proper order, and are then left in continuous working; from this time on, the control dashes appear upon the strip, showing that all is in good order, according to the second series; when all the operations are carried out, which does not require more than one or two minutes, a spark is made in the interval which is allotted to the distributor motor, and this is stopped, leaving the operating devices in working order. Check observation—12 P. M.: the operator wishes to see whether the distant post is working in order; by sending a spark he starts up the motor of the distributor; the signals of the automatic telegraph are again seen on the band, accompanied by the check signals or dashes, which show that the apparatus is working; after checking in this way, a spark is sent in the motor interval and the motor is thrown off. Stop 4 A. M.: sending a spark causes the motor to start up; the check signals show that all has been working; the devices are stopped in the proper order by sending sparks in such

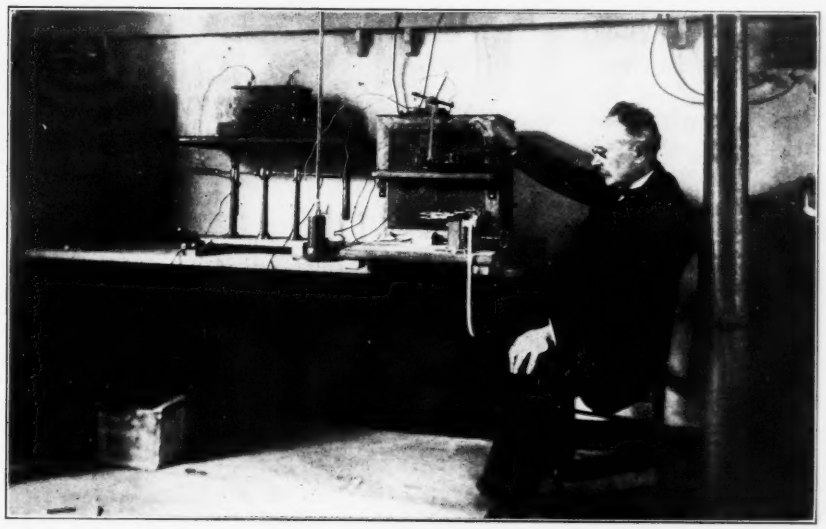


FIG. 8.—DR. BRANLY OPERATING SENDER.

intervals; last, the motor is stopped and the receiving post ceases to work entirely.

Such a system can be used for a great number of combinations. One of these which is of considerable interest is operated by using a set of twenty-six discs on the distributor, as of course the number of discs is unlimited. Thus twenty-six different effects can be produced, and these may be the printing of the letters of the alphabet. Seeing that the letters are formed quite independently of the number of sparks which are sent, but only by their position, the reading of the spark signals will give no information to an outside post, and the messages would thus be secret. Such an apparatus would need to be modified in detail so as to allow the messages to be sent quickly.

Among the practical applications may be mentioned, starting of a steam engine, starting or stopping a train, steering of airships without pilots, also of submarine boats, which may prove to be of great value, explosion of dynamite for mines, and many others. A very interesting experiment was carried out not long since at the French torpedo station of Antibes, on the Mediterranean. Messrs. Lalande and Devaux had invented a new form of submarine torpedo boat, and it was fitted with Dr. Branly's apparatus which operated the steering and controlled the speed, besides the launching of the torpedo. Operations were carried on in the bay of Antibes, the torpedo being launched against the cruiser Saint Louis. It was shown that the torpedo boat could be controlled very well from the operating post on shore, and the torpedo was launched with considerable precision.

The different views show the devices which Professor Branly has mounted in his laboratory. Fig. 5 represents the tripod coherer mounted on a Morse receiver, together with a sensitive Claude relay. Fig. 6 shows the metallic case of the coherer in the receiving station, with the distributor mounted on the top, and the electric motor which is coupled to the latter. The relays for the different work-circuits, which are all worked by the Claude relay, are placed together in a single case (Fig. 7). In Fig. 3 is shown a view of the automatic telegraph and the solenoid which is used to operate the contact, also the induction coil on the left, and the oscillator. Fig. 8 shows the sending station, with the coherer enclosed in a metal case, induction coil and oscillator and mast. Dr. Branly is engaged in sending signals by means of the key, and at the same time observes the paper strip of the automatic telegraph.

REGENERATION OF POWER WITH SINGLE-PHASE ELECTRIC RAILWAY MOTORS.[1]

BY WILLIAM COOPER.

The conditions necessary in order that an electric motor may operate successfully in regenerating or restoring power to the supply circuit are:

1. The counter pressure generated by the motor must be greater than the impressed pressure of the supply circuit.

2. The value of this excess counter pressure must be under control and maintained in suitable relation to the impressed pressure.

3. There must be at the time other power-consuming devices connected to the supply circuit.

There is no difficulty in producing the first condition; the second is the one that is difficult to fulfil. There are two methods of regulating the counter to the impressed pressure; one is to increase the counter pressure and the other to reduce the impressed. The third condition, except in isolated cases, will be taken care of by the operating load.

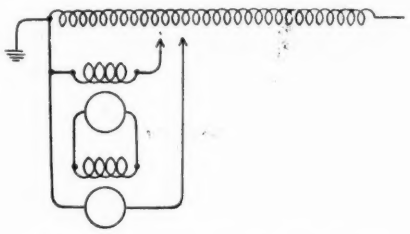


FIG. 1.—ARRANGEMENT OF MOTORS AND CONNECTIONS.

Practically all variable-speed railway motors are of the so-called series type, and this type of motor alone will be considered.

The operation of a series-dynamo electric machine as a series generator on a constant-potential circuit is a problem which many have grappled with, but none has solved. The machine must be given a shunt characteristic of a greater or less degree in order to make such operation possible. And this is not the only condition which the motor must fulfil in order to operate successfully as a generator in restoring power to the supply circuit. The motor must operate satisfactorily while the armature current is varied through a wide range with a constant field.

Assume that the car or locomotive being driven by the motor under consideration has attained a balanced or free running speed under the conditions. The motor is then developing only sufficient torque to overcome the train resistances. The motor, being a series machine, has the same current in the field and armature. Under these conditions a very slight increase in the field current would increase the counter electromotive force of the armature to a value greater than the impressed electromotive force of the supply circuit.

Now assume an ordinary series motor in which the armature current can not be increased materially above the corresponding field strength without disturbing the commutating conditions; it follows that the motor acting as a generator can only give a retarding force approximately equal to the train resistances. This added to the train resistance would give a total retardation so small that it could not be called a braking effect. From this it is obvious that the armature current must exceed the field current at times in order to produce a retarding effect which can be utilized in bringing the train to rest, or in holding the train on a grade. This, then, is another condition which the ordinary series railway motor does not readily fulfil.

From the foregoing it would seem that a motor to operate successfully as a regenerator of power must have the following characteristics:

1. It must be capable of operating through a wide range of variation between field and armature current, and

2. It must be provided with some means of producing a shunt characteristic.

The first characteristic exists to the fullest extent in a motor having some means of compensating for armature reaction, as well as a means of maintaining a constant commutating condition. This characteristic also exists to a limited extent in a motor having either one of these functions.

In the single-phase alternating-current motor of the series type these necessary characteristics are inherent. The machine is provided with a compensating winding to neutralize the armature reaction, and also has preventive leads between commutator and armature windings which assist in commutation. This construction yields the first characteristic; the second is easily obtained in connection with the transformer used in the voltage control of the motor.

The method of producing this result is to use one of the motors of the equipment as an exciter for the others. By providing the transformer with suitable voltage taps, the value of the field current of the exciter may be varied through a

[1] A paper presented at the annual convention of the American Institute of Electrical Engineers, Niagara Falls, N. Y., June 28. Slightly condensed.

wide range, as well as the generated voltage of the restored power.

The exact arrangement of the motors and their connections is shown diagrammatically in Fig. 1.

Assume the car or locomotive upon which the motors are mounted to be in motion, the armatures turning at a corresponding speed. If the field of the first machine be connected to the transformer, an alternating electromotive force will be generated by its armature, the value of which will be directly proportional to the speed. If the field of the other motor be connected to the exciter armature, an alternating current will pass through it, and the second armature will in turn generate an alternating electromotive force the value of which varies about as the square of the speed—the excitation of the first machine remaining constant.

The electromotive force generated by the second armature will bear a very close phase-relation with the electromotive force of the transformer, for the reason that the current in the field circuit connected to the transformer lags approximately ninety degrees, as does the current in the field circuit of the second machine. This combination throws the generated electromotive force of the second machine approximately 180 degrees back of the transformer electromotive force, or, by reversing the connections, in the same phase-relation. This deduction is confirmed by oscillograph tests. Under these conditions the current flowing after the circuit is closed with the connections reversed, will be displaced from the electromotive force, due to the impedance of the armature circuit. From certain tests it was found that when the generating machine was carrying 100 per cent overload the power-factor was eighty per cent. The power-factor varied between this and 100 per cent as the load decreased to zero. The obvious method to improve the power-factor is to shift the phase-relation of the generated to the line electromotive force. No difficulty has been found in restoring power with a single-phase commutator type motor at practically 100 per cent power-factor, the machine operating as a non-synchronous alternating-current generator.

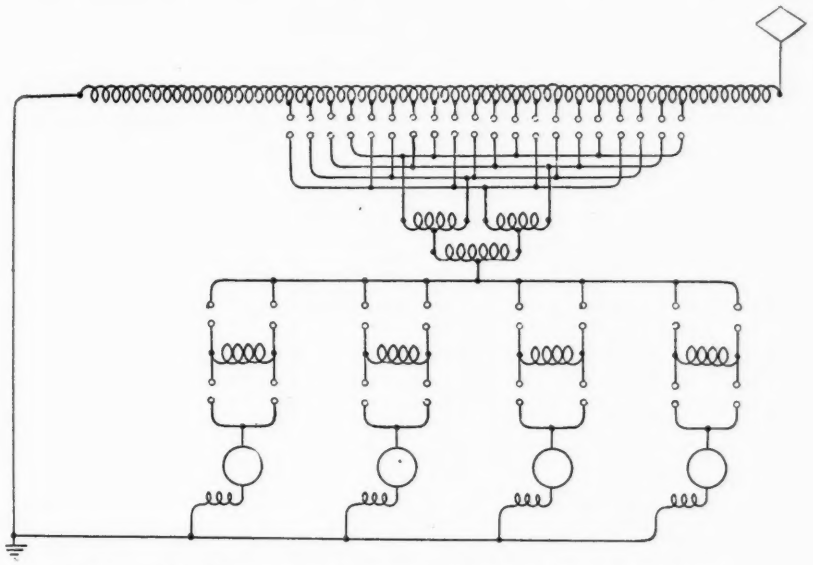


FIG. 2.—MAIN CIRCUITS AND CONNECTIONS OF FOUR-MOTOR EQUIPMENT.

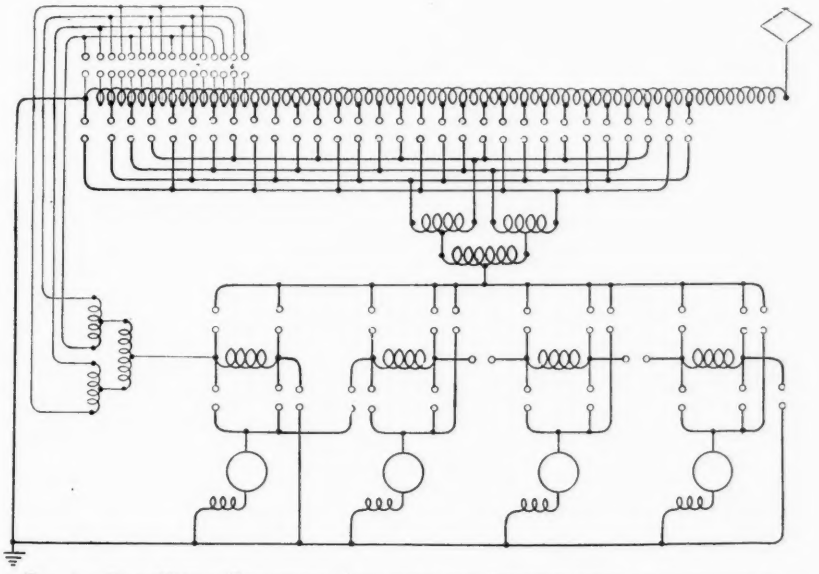


FIG. 3.—FOUR-MOTOR EQUIPMENT ARRANGED FOR REGENERATION, IN ADDITION TO REGULAR MOTOR CONTROL.

This condition being established, the next step is to see how it applies to actual operating conditions. From the foregoing it is evident that one of the motors of the equipment must be set aside for use as an exciter for the others, or a separate motor-generator set must be provided. If a separate source of excitation is provided, all the motors can be used to the fullest extent for regeneration of power, in which case the total capacity for regeneration will be increased over the capacity of the machines as motors by the increase in the power-factor. If the regenerative function is to be used for braking in making frequent stops, it might be desirable to supply the separate excitation; but if it is to be used in holding the train on grades it is unnecessary, as the remaining motors, if the equipment consists of three or more motors, will have ample capacity to do the work.

Assume a two per cent grade of considerable length. The motors, all working, have sufficient capacity to haul the train up the grade. Assume the equipment to consist of four motors. Assume train resistances at six pounds per ton. The total tractive effort will then be forty-six pounds per ton in ascending.

To hold the train at the same speed in descending, a retarding force of thirty-four pounds per ton must be supplied. The retarding force necessary is then approximately seventy-five per cent of the force necessary to haul the train up the grade. It is evident from this that three of the four motors have ample capacity to exert the necessary retarding force, even if the power-factor of the machines as generators is no better than when they are operating as motors. It has been shown that the power-factor when operating as generators can be made better than when operating as motors; therefore, there is a

surplus of capacity in four-motor equipment and in three-motor equipment about an equal capacity.

The characteristics and capacity of the machines being correct for the work, it only remains to provide suitable means for manipulating the circuits to adapt the apparatus to the conditions. This is accomplished by providing switching apparatus to connect the motors in the proper relation and for furnishing and controlling the field current of the machine used as an exciter.

Fig. 2 shows diagrammatically the main circuits and connections for a four-motor equipment. From this it is evident that the switches used must have a current capacity the same as the motors, for there are four in parallel on the transformer and the switches used for reversing carry the current for one motor only. As shown, thirty-six switches are required for the entire control of the motor equipment.

Fig. 3 shows diagrammatically the same motor equipment arranged for regeneration in addition to the regular motor control. As shown, fifty-four switches are required of the motor-current capacity, and sixteen of one-fourth that capacity. Of the added switches of the motor-current capacity, ten have been added to the transformer to enable slow speeds on regeneration to be obtained, and eight are required to change the combinations of the motors. Besides the added switches, three small preventive coils and a few additional transformer taps are required. From this it is seen that the amount of additional apparatus required is insignificant compared with the result accomplished.

The curves shown in Fig. 4 give the relative tractive and retarding effort, both continuous and maximum, of a four-motor equipment.

As shown by the curves in Fig. 4 the three motors of a four-motor equipment acting as generators restoring energy to the line will let a train down a two per cent grade at any speed from nine miles an hour to thirty miles an hour that the motors have capacity to haul up the same grade at any speed up to 18.5 miles an hour. This is for continuous duty. At maximum duty for short periods the capacity is increased about sixty per cent. Between nine miles an hour and thirty miles an hour there are forty operating speeds, the gradations from one to the other being such that at no time will there be any variation exceeding ten per cent in torque. This necessitates, of course, a rather large number of switches being used, but seems to be a very desirable condition to fulfil in heavy freight traffic.

The efficiency of the system when the motors are operating as generators and restoring energy to the supply circuit is about the same as the efficiency when operating as motors, there being perhaps a slight advantage in the case of the generator, due to the improved power-factor conditions. This, of course, assumes about the same load conditions on the machines in either case. However, the actual saving in power-house output can never be a very large percentage. If the entire road consisted of two per cent grades and there was no switching to be done, the saving in power consumption might be as high as fifty per cent, while under ordinary conditions it could not be made to exceed one-half of this, and under unfavorable conditions or with a level track and long runs, using the regenerative function only for braking, the saving could not be more than a few per cent.

The value of this system of regeneration is not to be found so much in the saving of power as in the saving in wear and tear and the ability to operate over a wide range of speed, as well as the comparative safety of operation. In the case of running heavy trains down long grades, the braking apparatus of all cars in the train can be held in reserve, it being necessary to use it only in emergency or in making the final stop. Under these conditions the number of accidents due to the failure of the brakes would be very much reduced.

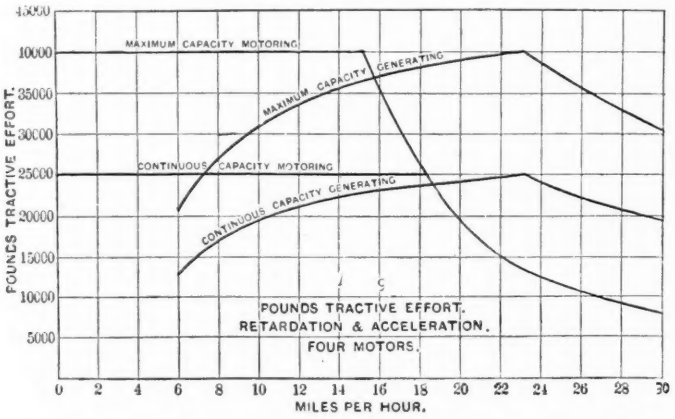


Fig. 4.—Pounds Tractive Effort, Retardation and Acceleration. Four Motors.

This is the only system of regeneration yet developed which can be operated at maximum efficiency over a wide range of speed. In the case illustrated forty speeds between nine miles an hour and thirty miles an hour are obtained. This number can be increased, if desired, simply by the addition of a few switches.

It will be noted that in this system the impressed voltage is changed to adapt it to the generated. This wide range of working voltage, together with the ability to vary the armature current with respect to the field through a wide range, gives to the single-phase series motor the extreme flexibility as a regenerator of power that it has as a motor.

One other point that is worthy of note in connection with the operation of this system is the absolute safety and stability of the combination. While the machines being operated as generators are normally series machines, it will be noted that no one of the armatures is connected in series with its own field, and under no condition can there be any surging or building up of load. In case of momentary interruption of the supply circuit, the circuit again being restored, the system will again operate exactly as before the interruption, there being no surging or violent action of the machines.

The system of regenerating power here described has been used in testing locomotives to give a dead-load condition under a wide range of speed.

Numerous stand-tests have also been made, so that the operation of the motors under the conditions is well established and there is no doubt about the scheme doing all that is claimed for it.

New Trolley Express Company.

A new company to take over the express business on the Massachusetts trolley lines controlled by New York, New Haven & Hartford Railroad interests has begun operations. It will take charge of all express matter intended for transportation over these street railway lines, thus relieving the operating department of any care other than that of keeping the cars running on schedule. The new company was incorporated a few weeks ago under the title of the Electric Express Company.

The Rio de Janeiro Tramway, Light and Power Company.

The annual general meeting of the Rio de Janeiro Tramway, Light and Power Company was held at the offices of the company, Toronto Railway Chambers, Toronto, Ontario, July 2, 1907. The first annual report contains some very interesting information, an abstract of which follows:

"The company was incorporated in Toronto, under the laws of Canada, in June, 1904, to acquire and operate valuable concessions and privileges granted by the governments of the republic of Brazil and of the state of Rio de Janeiro, and by the council of the city of Rio de Janeiro, to carry on an electrical business in the federal district and in the city and state of Rio de Janeiro, and to acquire two great water powers, and construct and install the necessary hydraulic electric plants, and generate and supply electric current for purposes of traction, power and light.

"The water powers are situated: (1) on the Rio das Lages, fifty-six miles from Rio de Janeiro; (2) at Sapucaia on the Rio Parahyba, about 100 miles from Rio de Janeiro.

"After a careful examination of the situation, the directors decided to develop the former water power first, and to hold the latter in reserve, although at the time of coming to this decision it was believed that the Rio das Lages was only capable of developing 40,000 horse-power, while the Sapucaia power can easily develop 100,000 horse-power in the dryest season.

"Since the commencement of construction the clearing of the banks of the Rio das Lages has disclosed that the reservoir formed by the dam which the company is building at Rio das Lages will have a much larger capacity than was anticipated, and consequently a much greater power can be developed, and, by a recent concession from the state of Rio de Janeiro, the company has acquired the right, if and when it desires, to tap the neighboring watershed of the Rio Pirahy, which will insure sufficient water to develop a total of 120,000 horse-power at Rio das Lages in the dryest season.

"The company is the absolute owner of the banks of the Rio das Lages, from a point some distance from the power-house, and extending up stream to the highest points to which the water will be backed by the dam, a total distance along the river of some twenty-two miles. The authority to use the hydraulic force of the river is derived from the common law right, as owner of the river margins, as well as from a concession of the government of the state of Rio de Janeiro, the competent authority. This concession is in the form of a contract, is perpetual, and can not be revoked, and no additional onus or obligation can be imposed on the company.

"In this hydroelectric concession all state and municipal taxes in the state of Rio de Janeiro are fixed in one annual contribution for a period of fifty years; power is given to supply electricity throughout the state, and to all the cities and towns thereof, and it is expressly declared that if any new favor be in the future given by the legislature to any hydroelectric enterprise, the same shall be extended to this company, and the obligations of the company in regard to construction, operation, and maintenance of the works, are reasonable, and free from vexatious restrictions. The company also owns all the necessary marginal land for a future development at Sapucaia, and the concession above referred to also extends to this enterprise.

"The company also acquired from the federal government and the municipal council concessions giving the exclusive right to furnish electrical energy, generated by hydraulic installation, within the city and federal district, and the right to construct and maintain an overhead and underground system of canalization for distributing the electric energy for power and light, subject only to certain rights of the gas company hereinafter referred to. After June, 1915, this concession continues, but without any exclusive right until 1950, but the ownership of the extensive system of underground canalization occupying all the principal streets practically insures the company against unreasonable competition.

"The directors deemed it advantageous to immediately construct at Rio das Lages a preliminary hydroelectric plant, and power from this source was made available for use within the city of Rio de Janeiro during March, 1907. The main upper fall of the river has been used for the purpose, and a temporary power-house of wooden frame and corrugated iron was built. This plant has a capacity of 3,400 horse-power and will be utilized for furnishing all the lighting and power required for the construction work at Rio das Lages, as well as for supplying light and power in Rio de Janeiro over the permanent transmission lines which are already completed. Meanwhile, the main installation at Rio das Lages is being rapidly constructed. A concrete and masonry dam is being built at the top of the falls, 115 feet in height, and ninety-two feet in thickness at the base. This structure stands on a solid granite foundation, both at base and sides, and will close up the valley above, in which will be impounded sufficient water to guarantee under the present development a maximum load of at least 50,000 horse-power.

"The total area of the lake above the dam is about seven and one-quarter miles. The water passes through controlling gates and riveted steel pipes 6,000 feet in length from the reservoir to the distribution receivers immediately above the power-house. From the receivers are led out six thirty-six-inch pipes about 1,900 feet in length, each to its own turbine. These pipes are laid on a steep grade, the receivers being located about 900 feet above the power station. The total head with the reservoir full is about 1,030 feet from the spillway level on the dam to the nozzles of the turbines, representing a pressure of 445 pounds to the square inch. At the power-house are being installed six main wheels, each developing about 9,000 horse-power maximum capacity, to which are connected generators of the stationary armature and revolving field three-phase type, designed to operate at fifty cycles, with a normal voltage of 6,000, and a maximum potential of 6,600 volts. The voltage of current from the generators will be stepped up to 80,000 volts with a maximum overload potential of 88,000 volts for transmission to Rio de Janeiro over the four transmission circuits.

"The whole of the above work has progressed from the outset, and is progressing in the most satisfactory manner. Almost all the material is already, or will be immediately, on the ground. It is hoped that the first generator will be at work during the summer and all six before the end of the year.

"There are two separate lines of transmission to the city, each with two separate circuits, located on the private rights of way of the company, acquired by purchase. The company has constructed about 220 miles of underground canalization under the streets of the city and has built sixty-nine large transformer and distribution chambers under the pavements and has already installed 350,000 feet of cable. This distribution system was brought into service on March 16 and operated satisfactorily.

"The company has from time to time

acquired the control of almost all shares in the following companies:

	Percentages of Shares Held.	Track Mileage.	No. of Cars.	No. of Mules.
The Campanhia de Sao Christovao	98	44.25	170	2,716
The Campanhia de Carris Urbanos	99	34.33	169	2,062
The Campanhia de Villa Isabel (except four shares)	All	47	About 40 miles electrified.	
The Campanhia de Tijuca	All	4.66	Electrified.	
The Campanhia de Cocovado	All	2.33	Steam.	
The Societe Anonyme du Gas de Rio de Janeiro	94			
The Brazilianische Elektricitats Gesellschaft (Telephone Company)	All			

"The company has also acquired the control of nearly 11,000 out of 25,000 shares, and the whole of the debentures of the Carioca Tramway Company.

"The tramways controlled by the company operate about three-fourths of the total tramway mileage of Rio.

"In every case the concessions of the above tramway companies are exclusive, each within its own zone, and cover the business centre of the city, and, with one exception, all of the important suburbs. The Sao Christovao concession expires in 1950; the Villa Isabel in 1945; the Tijuca in 1940; the Cocovado in 1931; the Carris Urbanos in 1930.

"The gas company concession expires in 1945, and is exclusive for private gas and for street lighting by electricity or gas until 1945, and for private electric lighting until 1915.

"The telephone concession granted in 1898 is absolutely exclusive for the whole federal district until 1928, when it expires.

"The company has installed a model modern telephone equipment, designed with a capacity of 4,900 subscribers' lines, and already over 3,500 lines are now arranged for connection.

"It is not possible to give definitely the earnings of the combined undertaking for the year 1906, as the various properties have been acquired and gradually brought under the company's control during that year. A close estimate, however, has been made as follows:

	Gross.	Working Expenses.	Net.	Percentage.
Year 1906....	$5,575,000	$4,010,000	$1,565,000	72

The earnings of the current year have been as follows:

	Gross.	Working Expenses.	Net.	Percentage.
Jan., 1907....	$468,125	$323,125	$145,000	69
Feb., 1907....	448,125	299,063	149,062	67
March, 1907..	479,687	321,562	158,125	67

being at the annual rate of:

Gross.	Working Expenses.	Net.
$5,583,748	$3,775,000	$1,808,748

The officers of the company are William Mackenzie (Toronto), president; F. S. Pearson (New York), vice-president; Frederic Nicholls (Toronto), vice-president; Alexander Mackenzie (Rio de Janeiro), resident vice-president; J. M. Smith (Toronto), secretary-treasurer.

THE SINGLE-PHASE MOTOR AND CITY TROLLEYS.

BY WALTER I. TAMLYN.

With the increasing use of the single-phase motor for interurban trolley systems, it becomes interesting to inquire whether this motor will in time replace the direct-current type for city work. Because of the elimination of the rotary-converter substation with its great initial cost and its high maintenance expense, it has been possible to build successful single-phase trolley roads in thinly populated rural districts where the direct-current system would have been impossible from a financial standpoint. It ought to follow, therefore, that the elimination of the rotary-converter substation in urban systems would be very desirable. If, then, the single-phase motor were suitable for city work, we might expect to see it entirely replace the direct-current type in a few years.

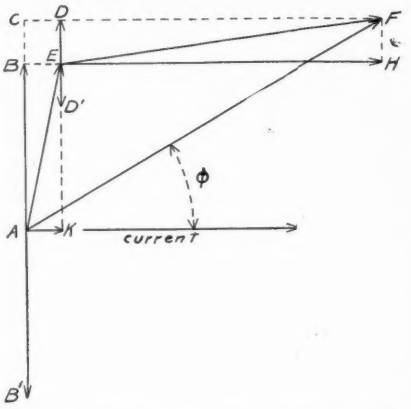


FIG. 1.—DIAGRAM OF THE ELECTROMOTIVE FORCE RELATIONS OF A SINGLE-PHASE MOTOR AT FULL SPEED.

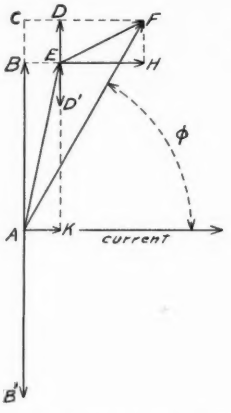


FIG. 2.—VOLTAGE DIAGRAM OF A SINGLE-PHASE MOTOR WHEN STARTING.

It has been said that the single-phase railway motor has the same characteristics as the direct-current railway motor. It is true that the speed and torque curves of the two motors have the same general relations, and that the efficiencies of both are high over a wide variation of load. But because it is on an alternating-current circuit the single-phase motor has a power-factor which may be high under some conditions, but which must always be less than unity. For the sake of argument, the power-factor of the direct-current motor may be considered as being equal to unity under all conditions. The value of the power-factor of a single-phase motor and its variation with different conditions may be conveniently examined by means of voltage diagrams. Fig. 1 represents the electromotive force relations of a single-phase motor when running at full speed. AE is the electromotive force on the field-windings made up of the inductive component AB and the energy component AK. AB neutralizes the counter electromotive force of field self-induction AB^1; AK represents the losses in the field, principally the I^2R loss. EH is the energy component of the armature voltage, EF; and ED is its inductive component. The inductive component of the armature voltage, when the motor is operating at full speed, is much smaller than its energy component. This is because the counter electromotive force of self-induction of the armature is small as compared to the same quantity in the field and the energy component of the armature electromotive force represents the energy converted into useful work by the motor in addition to armature losses. AF, the resultant of AE and EF, represents in direction and magnitude the total electromotive force on the motor. AF leads the current by the angle Φ, the cosine of which is the power-factor of the motor. In Fig. 1 the angle Φ is thirty degrees, and consequently the power-factor of the motor is 0.87 when operating under the given conditions. In a compensated motor the compensating windings tend to neutralize the inductive component of the armature voltage; the result being that the armature voltage, EF, tends to have the same direction and magnitude as its energy component EH. It is evident that the power-factor of a compensated motor is higher than that of an uncompensated motor.

The inductive components of the field and armature electromotive forces vary with the current input, but are independent of the impressed voltage and also of the power output. Fig. 2 is the voltage diagram when the motor is starting if the current has the same value as corresponds to the conditions of Fig. 1. The

inductive electromotive forces AB and ED and the energy component of the field electromotive force have the same values as when the motor is running at full speed. But the energy component of the armature voltage EH is small, since the power output of the motor is low, although the torque may be very high. The cosine of the angle Φ in Fig. 2 or the power-factor, is 0.5 since the angle Φ equals sixty degrees. The above is not intended to give the impression that a single-phase motor is a constant-current motor; as a matter of fact, the current at low speed is necessarily greater than the full-speed current. But if the current in Fig. 2 is greater it is evident that the power-factor will be still lower, so that the assumption of a constant current at different speeds is a perfectly safe one for the present purpose.

It has been shown that the power-factor of a single-phase motor is very low when the motor is starting, but assumes a high value (in some cases as high as 0.9) when the motor is up to speed. The low power-factor does not mean an increased consumption of energy; on the contrary, it acts to keep the value of the current lower than it would be in a direct-current motor on the same voltage. The result is that the time required by a single-phase motor to attain full speed is greater than that required by the corresponding direct-current motor. A great many engineers, who have had occasion to ride on single-phase roads, have confirmed this conclusion by the statement that the acceleration of an alternating-current car is like that of a steam locomotive, much slower than the familiar quick acceleration of the usual direct-current car.

The average trip of a car in a city trolley system is made up of a succession of starts and stops, while an interurban car stops infrequently, and runs of considerable distance at full speed are the rule. Therefore it is essential that the city car be capable of getting up to speed quickly in order to make suitable headway, but the time and distance required for the acceleration of the interurban car are of minor importance.

In view of the requirements of the two kinds of service and the characteristics of the two types of motor, it would appear that the single-phase motor is unsuitable for city work, although its simple power system makes it peculiarly adapted for interurban roads, where its low rate of acceleration is not a serious disadvantage. On the other hand, the direct-current motor itself is suitable for both kinds of service, but the expensive substations and the large amount of feeder copper required in connection with it make its use almost prohibitive on interurban trolleys, except where the traffic is very heavy. The natural conclusion to be drawn is that there is a large field for the single-phase motor for interurban roads, but that it is not likely to replace the direct-current type on the street railways in cities.

The Baltimore Electric Company.

The first statement of earnings of the Baltimore Electric Company has been made public. This company was formed recently by the consolidation of the Maryland Telephone and Telegraph and Baltimore Electric Power companies, and the earnings announced are for both properties. The statement compares the results for the first five months of the year with those of the corresponding five months of 1906, and the earnings for the year 1906 are also given. The net earnings last year amounted to $55,676.83, while the net for the first five months of the current year totaled $47,065.44. The net for the corresponding five months of 1906 was $12,570.87, so that the increase for the period is $34,494.57, or 274.40 per cent.

The corporation since completing its financial arrangements several weeks ago has started a vigorous campaign for business in its various departments. Mr. David E. Evans, president of the company, in speaking of the plans, said:

"The Baltimore Electric Company has now completed all its financial arrangements, and we are going to push the business to the utmost. Our securities are widely scattered, and regular statements of earnings will be issued, so that the public may know what we are doing. The statement which we have given out shows that the company is making great strides. The net earnings for the first five months of the year show an increase of over 270 per cent, as compared with the earnings for the corresponding period of 1906.

"We plan to greatly increase our facilities. Our plant has already been enlarged since it was put into operation during the summer of 1905, the building 100 per cent and the electric and steam equipment fifty per cent. It is our intention to add fifty per cent to the plant."

The plant of the Baltimore Electric Company now has a capacity of 9,000 kilowatts, and it is understood to be the intention of the company to at once increase this to 12,000 kilowatts.

Honors for Electrical Men.

Among the honors announced on the occasion of the celebration of the birthday of King Edward, the following are of interest to electrical men:

The Right Honorable Sir James Kitson is made a peer. Sir James was chairman of the select committee of the House of Commons which considered the original proposals for the formation of power companies.

Sir Charles Scotter is made a baronet. Sir Charles is the present chairman and was the former general manager of the London & Southwestern Railway Company. His electrical work has been chiefly in connection with the Waterloo & City Railway.

John Gavey is made a knight. Mr. Gavey was the former engineer-in-chief of the British post-office, and is a past-president of the Institution of Electrical Engineers, of Great Britain. His electrical work has been in connection with improving the telephone and telegraph systems of Great Britain.

Dr. J. A. Ewing is made a Commander of the Bath. Mr. Ewing is well known for his scientific work, particularly in the subject of magnetism, and more recently in wireless telegraphy.

Dr. R. S. Watson was made a privy councillor. Dr. Watson is a director of the County of Durham Electrical Power Distribution and the Newcastle-upon-Tyne Electric Supply Companies.

Surprise Test of Automatic Block Signaling System.

Some interesting tests have been made by the Lehigh Valley Railroad, the object of which was to find out whether the signals given by the automatic block-signal system, which have been used by this railroad for some years, are obeyed by the train men. On May 9 the signals at Flemington Junction, N. J., were disarranged purposely so that they stood at "danger." During the time of the test thirty-six trains passed in both directions and all came to a full stop on approaching the signal.

A similar test was made on May 23 on the M. & H. division, the automatic signals being disarranged so as to stand at "stop." During the time of dissarrangement, nineteen trains approached the station and all came to a stop.

On June 14 a similar test was made on the Wyoming division with similar results, all signals being obeyed by the train men. In addition to these tests, others were made on other sections of the road, and in no case was any signal disobeyed.

National Electrical Contractors' Association.

Seventh Annual Convention, Held in New York City, July 16-19.

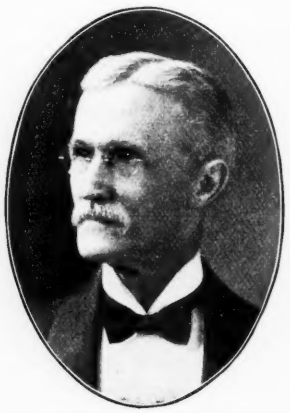
IN the last issue of the ELECTRICAL REVIEW, a brief report was published of the first session of the seventh annual convention of the National Electrical Contractors' Association, held in New York, July 16, 17, 18 and 19.

As announced last week, the sessions held on Wednesday and Thursday were open sessions; that is, those of allied electrical interests were invited to attend. The other sessions were executive meetings, and only accredited members of the association and delegates were admitted. The business sessions were held in the assembly room of the Engineering Societies Building, 29 West Thirty-ninth street, though the convention headquarters were established at the Hotel Imperial.

Although the temperature, during the days of the convention, was exceedingly high, the sessions were well attended by members of the association; and, in addition, a fair representation of the manufacturing interests relating to the electrical contracting industry was present.

JAMES R. STRONG,
President.

G. M. SANBORN,
First Vice-President.



JOHN R. GALLOWAY,
Treasurer.

W. H. MORTON,
Secretary.

The committee on registration, consisting of W. C. Peet, George W. Russell, Jr., and C. A. Christesen, reports a very satisfactory attendance.

Alex. Henderson, master of transportation, made his headquarters at the Imperial Hotel and the Engineering Societies Building, and put forth every effort to facilitate the railroad service for those present.

At the first open session, on Wednesday, July 17, a paper was read by Professor George F. Sever, consulting electrical engineer for the city of New York, on "The Relations of New York City with the "Electrical Contractor." He said in part:

"The function of municipal government is to control all matters entering into the daily life of the citizen to the end that his life and property may be fully and carefully protected. Under this proposition the municipal government has been divided into different departments, each one of which has supervision over one or more branches of municipal activity. Assigned to each department is a corps of inspectors whose function it is to supervise the construction and installation of the many materials which enter into the building up of a community. They are required by their oath of office to carry out the regulations of the city charter and the ordinances which are promulgated from time to time by the board of aldermen or other properly constituted authority. They should be thoroughly equipped on the technical side of their work; also possess force and tact in the administration of the rules governing their specific line of engineering.

"There is another supervising body which probably has a more potent influence over the manner of electrical installations than any municipal body, this being the National Board of Fire Underwriters. It, working through the Underwriters' National Electric Association, promulgates what is known as the National Electrical Code, the rules of which are designed to minimize or prevent the starting of fires and the consequent destruction of property which carries insurance in the companies holding membership in the National Board of Fire Underwriters. Over those buildings which carry insurance in these companies, there is exercised a much stronger control by the inspectors and governing officers than seems to be possible by the inspectors of the municipalities. This should not be the case. If a building does not carry insurance and contains a hazardous electric installation, the power of the underwriters can only be apparent through the change in rate on insured property adjacent thereto. In this case the municipal authority can be appealed to for the purpose of removing the hazard.

"There has been, up to within a short period, another authority whose inspection it was necessary to secure before an installation was placed in service. I refer to a local lighting or power company which does not care to have the wiring, which a contractor places in a house or factory, connected to its mains to cause trouble, even though it has passed the inspection departments of the underwriters, or the municipal inspector, if there be one. In many localities this inspection by the lighting company has been abandoned and dependence placed upon the certificates of inspection of the underwriters and the municipal department and also the standing of the contractor. This latter recognition is, I feel, one of the important steps in the direction of doing away with the multiplicity of control and inspections which has caused so much annoyance and disfavor in the past, and which is present even now where the underwriters and the municipality make either joint or separate inspections. In isolated plants, or where power is not taken from the mains of a power company, one inspection should govern, and if the municipal organization could so arrange, it might be well to recognize the

standing of the best electrical contractors and omit the detailed inspection of their work.

"Bearing immediately upon this subject is the question of the control over the additions and alterations made to existing installations by the men in responsible charge of the isolated or other equipment. Much work of this character is done and some is done in execrable fashion and against all the rules of the National Electrical Code and the locality. How should these be handled? The municipal inspector can not go over every installation each year or in any regular manner. An insurance inspector may not be called upon for some years to go over his former inspection and thereby find some changed conditions; and the owner of a building does not have his attention drawn to the fact that there have been changes which he should have called to the attention of the authorities. It is well recognized that any one with some skill and a few appliances can put up electrical devices and wiring, but in so doing may wholly fail to comply with those rules intended to safeguard that portion of an electrical installation which gives most of the trouble—the wire. It is for this reason that the situation is a difficult one to cope with and to solve equitably. If licensing is really the only cure, I fear that it will never be looked upon with favor by the community, as the public would not consider the danger sufficiently great to warrant shutting out workmen from small undertakings which may have but a small risk in them. And furthermore I do not believe in issuing licenses to the employer only, making a workman capable of doing some small and unimportant piece of work dependent upon an employer, or else take out a license for the sole purpose of doing the small job in which there is not sufficient profit to meet the license fee. In an art which is developing as rapidly as ours, I do not believe the time is yet ripe for this method of control under the suggested conditions which I have observed and studied. State licensing is that which I have in mind and the conditions surrounding the equable adjustment of the regulations, and the carrying out of examinations are not such as in my mind would warrant its establishment."

Following the address by Professor Sever, Arthur Williams, ex-president of the National Electric Light Association and chief inspector of the New York Edison Company, was introduced by President Strong, and read a paper on "The Relation between the Electrical Contractors and the Central Stations." He said in part:

"Well established is the practice of our central stations to leave to the electrical contractors the installation of interior equipment necessary to supply light, heat and power. With few exceptions, this appears to be the general rule.

"In the early days of the central station the custom was the free installation of wiring, safety devices and fixtures. This was necessary, for the possibility of the commercial distribution of electricity had not been demonstrated—at least not sufficiently to encourage any general change from the methods then in vogue. Few, relatively, considered the scheme practicable; many scientists of America and Europe denied the commercial, or even the technical, possibility of distributing electricity from a central station.

"However, the free installation of wiring and fixtures and the lending of motors, either free or on a rental basis, for the most part has been unsatisfactory. To free wiring there are many objections; customers are apt to desire a great deal more than they actually need, resulting in wasteful use of current; in dissatisfaction with the service; finally in the abandonment of a large percentage, if not all, of the investment.

"With free fixtures only the most inexpensive and simple are possible, resulting in unattractive installations and, again, in dissatisfaction with the service. Likewise with motors, which, although requiring little attention, do require some—daily and methodically; motors rented or installed free of charge receive no attention from the consumer, thus causing rapid deterioration, and, again, serious dissatisfaction with the service. The field of interior equipment as a whole is one where to insure best results—satisfactory equipment on the one hand and satisfactory service on the other—the installation must be made at the expense of and be maintained by the consumer.

"Naturally, the supplying companies must grow. If the growth is not rapid enough, they may try, temporarily or permanently, various ways of securing installations. But the best way in the judgment of many is, first, for the company to do its part in cooperation with the electrical contractors to make the field profitable, and, secondly, for the contractors to do their part in securing from the public a rapid utilization of the company's supplying resources. The responsibility is mutual, and can be ignored by neither.

"One way of securing this result is to create a demand by liberal advertising. For the most part, if not entirely, this is done by the supplying companies. Is there not, however, a good field for cooperation in mutual advertising?

"Inherently electric light is less dangerous than any other form of illumination, and the constant aim of those interested in the industry, in whatever branch, should be to make installation absolutely safe. Nothing could do more harm than the impression that electric wiring will increase fire losses, already enormous, or the insurance rates upon a building in which electric energy may be employed for one purpose or another.

"The contractors should not be quick in taking offence at such installation rules as the supplying companies may feel it incumbent to adopt. They should favor rather than oppose the very limited work within building lines which most of the companies do; this is in their interest as well as in the general interest; they should favor such rules as may be formulated looking to the concentration of protective devices and of meters.

"Toward the perfection of interior equipment marked progress has been made. Yet in many ways the tendency has been to increase the cost of equipment. One of the greatest needs of the present da is a simple and cheap, yet absolutely safe, form of installation through which those living in unequipped dwellings, apartments and tenements can obtain the advantages to be derived from electric light and power."

Following Mr. Williams, J. Robert Crouse, secretary of the Cooperative Electrical Development Association, read a comprehensive and interesting paper on the subject of "Cooperation."

The open session on Thursday morning was not called to order until about 11 o'clock, an hour after the scheduled time.

Hugh T. Wreaks, secretary of the Wire Inspection Bureau of the city of New York, read a short paper on the standardization of wire.

This was followed by a paper by T. C. Martin on "The Relations of the Press to the Contractor."

C. M. Goddard, of Boston, secretary of the Underwriters' National Electric Association, then read a paper on "Underwriters' Relations with the Contractor," saying in part:

"Notwithstanding the fact that in formulating the underwriters' rules, representatives of the various electrical interests had been freely consulted, still we

all felt the lack of a recognized standing for these rules among the varied interests, other than the underwriters, who were vitally interested in their application. It was therefore meet and fitting that the National Conference on Standard Electrical Rules should be brought into existence. The results of that body have been far more important, in the better feeling between all of the varied interests concerned, than in any real change or addition to the code itself.

"There is, however, one phase of the matter that is not as satisfactory, and that is, uniformity in the adoption, interpretation and enforcement of the code, by all the numerous inspection departments, both insurance and municipal. Improvement in this respect is of great importance to the contractors and it is of equal importance to the code itself. We must bury our own individual interests and accept the general consensus of opinion. The individual inspector must cease to be so egotistical as to think he is more likely to be right than the code, which represents the best talent available for such work.

"The various boards of underwriters throughout the country are really entirely independent of any orders from the companies. They are composed of men connected with the insurance business in the localities which they supervise and they are supposedly much more familiar with the needs of their particular localities than the officers of the companies, domiciled in some distant city, can possibly be.

"It is therefore the policy of the companies to leave the matters of detail as to management of insurance affairs in each locality to these boards, except perhaps broadly outlining the general policy which the companies desire them to pursue. It is by the results produced for the companies that these associations are judged, and if these results are satisfactory to the companies, the associations are supported and encouraged. This policy on the part of the companies can be fully defended from a business standpoint, and any attempt on their part to issue orders for every detail of the work would certainly be disastrous. While the companies in the national board have the undoubted right to demand absolute compliance with the code in every way, yet business policy makes that method out of the question and they therefore adopt the more effective, but slower way of moral suasion.

"If we work together we may expect the time to soon come when the code will be the only recognized authority for safe wiring from the property loss standpoint, and it will, more and more, also include those regulations which will be found necessary to protect life, for as a matter of fact, with few exceptions, the regulation of the one hazard regulates the other.

"Now when you ask what can be done to hasten this desired time, I would give the following advice:

"Uphold the code yourselves by defending it as a whole, by using your influence to improve it in regular manner where improvement is needed.

"Follow the code in what work you do, fully convinced that in the long run such a course will be to your advantage.

"Do not expect that you will induce others to follow the code if you only do so when you find the inspector is watching you, or because you feel you have to do so, while all the time you are criticizing its requirements.

"Be on friendly terms with the inspector, show him you mean to work to his satisfaction whether he is watching or not.

"When he has criticisms to make let him see that you are as anxious as he is to have the work made right.

"When you think he is wrong in his criticisms or ruling, tell him so frankly and show him where you think he is wrong and why.

"Do not accuse the inspector of finding fault just to hold his place.

"Do not let him feel that you think he is not fair. Remember he is human, like yourselves, and that he will naturally resent such imputations, just as you would. Also remember that the chances are even that he is just as honest as you.

"If you find a difference with an insurance inspector that you can not adjust satisfactorily between yourselves, then take it up with the national board, but let me say here, that I believe ninety per cent of the disputes can be settled without appeal. The national board has established a sort of court of appeals so that differences between an insurance inspector and any one else can be placed before the members of the Electrical Committtee of the Underwriters' National Electric Association, and the national board then renders a ruling based on the decision of the committee. This method of moral suasion has generally been effective, for few inspectors care to openly set their opinion against the rulings of the companies for whom they are working and the men with whom they have been more or less closely associated perhaps for years."

The last event on the programme in the open sessions was a talk, apparently more or less extemporaneous, though bearing the marks of careful thought, on "The Electrical Contractors' Association," by Charles L. Eidlitz, the first president of the National Electrical Contractors' Association. Mr. Eidlitz, after paying a tribute to the president, Mr. Strong, reached directly for the point he wished to make, which was to press the importance on the association and members, collectively and individually, of stopping the strife between the supply dealers and the electrical contractors. In most sarcastic, virile and logical reasoning, punctured by keen wit, which kept the meeting in a continuous uproar, Mr. Eidlitz tore to shreds the inconsistencies, as he defined them, of the present relationship of these two important electrical interests.

From this subject, he was led into a discussion of the commercial relationship of the manufacturers to the supply dealers and contractors, and this phase, too, of the electrical industry received trenchant analysis.

During the executive session of Wednesday, July 17, called somewhat after 2 o'clock, the reports of the committees, the report of the treasurer and the report of the secretary, and other routine procedure, were dealt with; and, on this day, no evening session was held.

The officers and board of directors elected are substantially the same as those of the preceding year, though it will be seen that some changes have occurred in the list of vice-presidents. Following are the officers of the association:

President—James R. Strong, New York city.

First Vice-President—G. M. Sanborn, Indianapolis, Ind.

Second Vice-President—Charles R. Kreider, Chicago, Ill.

Third Vice-President—F. C. Werk, Cleveland, Ohio.

Treasurer—John R. Galloway, Washington, D. C.

Secretary—W. H. Morton, Utica, N. Y.

Sergeant-at-Arms—J. C. Sterns, Buffalo, N. Y.

The directors are:

Arkansas—C. J. Drees, Little Rock.

Illinois—J. T. Marron, Rock Island.

Indiana—T. B. Hatfield, Indianapolis.

Iowa—Edward M. Kunkle, Davenport.

Maryland—H. P. Lucas, Baltimore.

Massachusetts—Seth B. Wetherbee, Boston.

Michigan—D. A. Britten, Detroit.

Minnesota—John Gorman, St. Paul.

Missouri—Charles J. Sutter, St. Louis.

New Jersey—Paul H. Jaehnig, Newark.

New York—J. C. Hatzel, New York city; M. L. Barnes, Troy; James Hilton, Syracuse.

Ohio—M. W. Hansen, Toledo.

Pennsylvania—W. J. Patterson, Pittsburg.

Rhode Island—F. W. Godfrey, Providence.

Texas—J. C. Kinney, San Antonio.

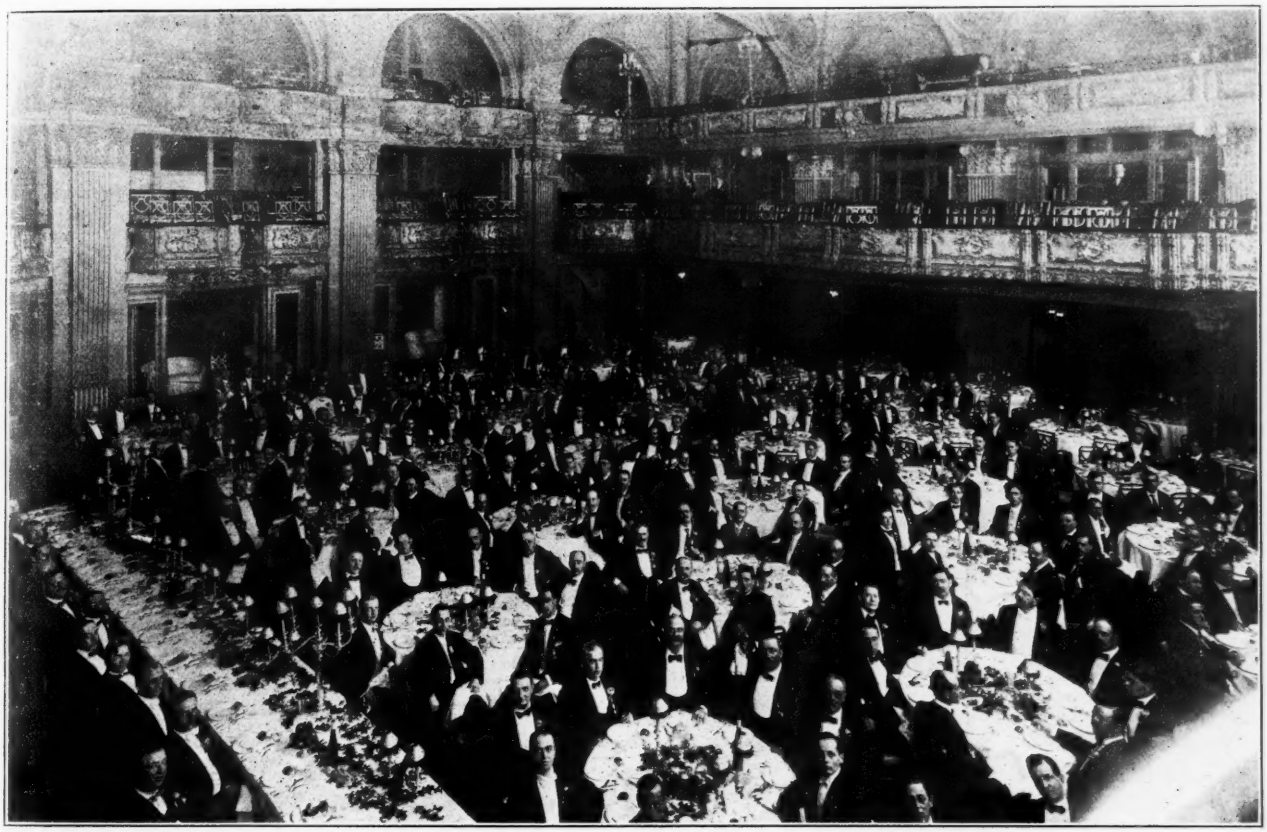
Wisconsin—George F. Rohn, Milwaukee.

It is understood that such dissatisfaction has existed in certain quarters, especially in the New England states, with certain policies involved in the conduct of the association, that many resignations have been received from those in the eastern or New England states, and that a new contractors' organization will be formed by these states.

The entertainment and social side of the convention was unusually well conducted. The entertainment committee consisted of the following members of the New York state association: Charles L. Eidlitz, chairman, and Marshall L. Barnes, C. A. Christesen, L. K. Comstock, George W. Russell, Jr., J. P. Hall, E. S. Keefer, W. Creighton Peet, James R. Strong and J. C. Hatzel.

The ladies' entertainment committee consisted of Mrs. Marshall L. Barnes and Mesdames H. A. Sinclair, J. B. Olsen, James Hilton, E. S. Keefer and Miss Slingerland.

The dinner given Wednesday night in the Astor Gallery of the Waldorf-Astoria comfortably filled the banquet hall. Instead of having toasts and after-dinner speeches, a vaudeville performance was given on a stage erected for the occasion. An exceedingly bright skit, entitled, "Not Yet, But Soon," written by Mr. Gilpin (V. C.), was much enjoyed by the assembly. Following is the list of characters:



ANNUAL BANQUET OF THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION AT THE WALDORF-ASTORIA.

"Mr. James Armstrong Tucker," an electrical contractor, played by George H. Watson.

"Miss Richardson Syracuse," his competitor, taken by George Shuman.

"Mr. Wouldent Keeper," his superintendent, taken by E. S. Keefer.

"Parke Hall," his office boy, taken by Archie Martin.

"Moore Patterson," the electrical engineer, played by M. I. Levy.

"Nutty McNulty," a labor leader, taken by James R. Strong.

George H. Watson, in the part of James Armstrong Tucker, satirized President James R. Strong, of the association, by showing that he was not satisfied with a paltry $2,000,000 profit.

An electrical calculating machine had been constructed, and it was very evident that the dial for adding the "profits" responded much more rapidly than the dial for equipment, labor or other factors entering into the cost of electrical work.

In estimating, a labor leader, secreted behind the machine, had interrupted its action, so that a $91,000 bid was entered, and Miss Richardson Syracuse (a reference to the only woman electrical contractor, Miss Rose Richardson, of Syracuse) entered the situation, and complicated matters by falling in love with Tucker's superintendent.

Preceding this, Thomas H. Bibber, in his inimitable manner, sang some popular songs, and was compelled to accept many encores. The duet which he sang with Miss Miner, of Detroit, made an especial hit.

Following this, Miss Cecelia Miner sang a solo, and her grace and artistic rendering were greatly appreciated.

W. P. Crockett, of Chicago, effectively entertained the gathering in the rôle of "Anna Eva Fake," by answering questions propounded by the audience.

A pretty episode of the first day's open-

ing meeting was the approach of several ladies, with escorts, to the president's rostrum. Mrs. James B. Olsen, the spokeswoman for the committee, presented a huge bunch of roses to the president, and made a graceful little speech of presentation.

A very enjoyable stag, smoker and vaudeville was held at Shanley's on Thursday evening by the association, under the charge of a committee of which J. P. Hall was chairman. About 500 of the members were present and sat down to prettily decorated long tables at 10 o'clock.

About 450 members and guests of the association enjoyed an outing on the steamer Glen to Witzel's Point-View Island on Friday, leaving New York at 10 o'clock, the committee in charge being E. S. Keefer, L. K. Comstock and Charles L. Eidlitz. After arriving at the island the first event was the ball game. At a call from the umpire the "Kilos" went to the bat to play against the "Watts." The nines were lined up as follows:

"Kilos"—Captain, Russell; first base, Webb; short stop, Dreffy; third base, Smith; centre field, Martin; right field, Brown; left field, Henlin; second base, Hatzel; pitcher, Adams; catcher, Grough. "Watts"—Captain, McCleary; first base, Swanson; short stop, Rueter; third base, Kunkle; centre field, Kinney; right field, Hutchinson; left field, Adams; second base, Crawley; pitcher, Fratzen; catcher, Button.

It was agreed that but five innings would be played, and as the result was a tie, the championship flag was presented to both captains, who marched around the field, each one holding on to the flag. This flag will be played for in Chicago next year.

At 1.30 o'clock the clam-bake was served in the dining hall.

The Glen left the island at 4.20 P. M., reaching the landing at Thirty-second street and East river at 6 o'clock, and thus ended one of the most enjoyable outings that the association has had.

The meeting this year was graced by a larger attendance of ladies than usual, the result of which was the formation of the Ladies' Auxiliary Association, of which the following officers were elected:

President, Mrs. J. R. Galloway; vice-presidents, Mesdames M. Barnes, J. B. Olson, E. McCleary; honorable secretary, Miss M. Carroll; recording secretary, Miss Miner.

The ladies of the committee who made a presentation of flowers to President Strong were Mrs. J. B. Olson, chairman, assisted by Mesdames Barnes and McCleary and Miss Carroll. On Friday the ladies presented Mr. Alexander Henderson, in token of his courtesies to them as master of transportation, a silver brush. Mrs. Olson was chairman of this presentation committee also.

Among the manufacturing interests represented were the following:

De Veau Telephone Manufacturing Company, New York—Albert S. De Veau, president, Thomas C. Walsh.

India Rubber and Gutta Percha Insulating Company, New York—R. T. Satterlee, J. B. Olsen.

American Conduit Manufacturing Company, Pittsburg, Pa.—Charles A. Flack, Thomas H. Bibber.

American Circular Loom Company, Chelsea, Mass.—A. F. Clark, Oscar Hoppe, Alex Henderson, R. B. Corey, Harry Adams, J. J. Myer, George Richards, M. F. King, F. M. Bryne.

Steel City Electric Company, Pittsburg, Pa.—J. M. G. Fullman, V. C. Gilpin.

Sterling Electric Company, Troy, N. Y.—H. A. Waterman.

Benjamin Electric Manufacturing Company, Chicago and New York—B. G. Kodjbanoff.

W. P. Crockett, manufacturer's agent, Chicago—representing Hart Manufacturing Company, American Conduit Manufacturing Company, Alphaduct Manufacturing Company, the Dale Company.

National Metal Moulding Company, Pittsburg, Pa.—C. E. Corrigan, H. B. Kirkland.

Buckeye Electric Company, Cleveland, Ohio—Milton Hartman, F. W. Bliss.

Alphaduct Manufacturing Company, Jersey City, N. J.—Russell Dart.

Thomas & Betts Company, New York—H. D. Betts, R. T. Harrison.

Pass & Seymour, Solvay, N. Y.—J. W. Brooks, A. M. Little, E. G. Mack, W. Brewster Hall.

Marshall Electric Manufacturing Company, Boston and New York—R. K. Slaughter.

John A. Roebling's Sons Company, Trenton, N. J., and New York—F. W. Harrington.

Harvey Hubbell, Incorporated, Bridgeport, Ct., and New York—Harvey Hubbell, H. M. Bliven, T. S. McLean.

Safety Insulated Wire and Cable Company, New York—A. P. Eckert, R. C. Wilson.

D & W Fuse Company, Providence, R. I.—W. S. Sisson.

I. P. Frink, New York—Frank Stout.

W. E. G. Mitchell, New York—Rudolph Miehling.

Sprague Electric Company, New York—H. G. Issertell, Finley Douglass.

B. S. Barnard Company, New York—B. S. Barnard.

New York Electric Controller Company, New York—George Weiderman.

Price-Faure, Ossining, N. Y.—J. B. Faure.

Troy Electric Company, Troy, N. Y.—E. G. Bernard.

American Electric Works, Phillipsdale, R. I.—G. H. Watson.

Dale Manufacturing Company, New York—O. J. Bryan, Herman Salt.

Crouse-Hinds Company, Syracuse, N. Y.—H. B. Crouse, F. M. Hawkins, H. H. Hornsby, C. M. Croofut, Bert Hills, A. H. Spahn.

New York Insulated Wire Company, New York—B. S. Hoover.

Trumbull Electric Manufacturing Company, Plainville, Ct.—Thomas W. Watson.

Western Electric Company, Chicago and New York—F. H. Wilkins, M. A. Oberlander, L. J. Baldwin, E. W. Rockafellow, E. S. Keefer, Major Robert Edwards.

Safety Armorite Conduit Company, Pittsburg, Pa.—Robert Garland, J. W. Garland.

M. B. Austin Company, Chicago—M. B. Austin.

R. B. Corey Company, New York—R. B. Corey, Harry Adams, James J. Sheeran.

Bossert Electric Construction Company, Utica, N. Y.—R. B. Corey, Harry Adams.

S. B. Condit, Jr., & Company, Boston, Mass.—S. B. Condit, Jr., S. W. Nason.

H. W. Johns-Manville Company, New York and Chicago—Arthur Frantz.

Nungesser Electric Battery Company, Cleveland, Ohio—H. S. Greene.

Machen & Mayer Electrical Manufacturing Company, Philadelphia, Pa.—Charles H. Machen.

Hart Manufacturing Company, Hartford, Ct.—William Taylor, W. P. Crockett.

National X-Ray Reflector Company, Chicago, Ill.—W. A. Patton.

Okonite Company, Limited, New York—George T. Manson, J. Langan.

Wirt Manufacturing Company, Burrage, Mass.—Represented by its agents, the Steers Supply Company, of New York.

Mark Manufacturing Company, Chicago, Ill.—D. L. Markle.

Wagner Electric Manufacturing Company, St. Louis, Mo.—E. W. Goldschmidt.

V. C. Gilpin, New York—manufacturer's agent, representing the American Conduit Manufacturing Company, Scranton Button Company and the Keough Electric Company.

Wisconsin Public Service Companies Increase Capital.

In anticipation of the enactment into law of the Hagemeiste bill, requiring public service corporations to get permission from the Wisconsin state railroad commission before issuing any stock or bonds and prohibiting them from selling stock for less than its par value or bonds for less than seventy-five per cent of their par value, the large Milwaukee public service corporations have filed amendments to their articles of incorporation enormously increasing their capital stock. The increases are: For the Milwaukee Light, Heat and Traction Company, $29,000,000; the Milwaukee Electric Railway and Light Company, $5,000,000, and the Milwaukee Gas Light Company, $4,000,000.

Success of the Electric Omnibus.

It is reported that the electric omnibus is killing the livery business in many of the towns of Alsace-Lorraine and Baden.

Report on Municipal Ownership.

The municipal ownership commission of the National Civic Federation has, for the past two years, been examining the principal cities of both the United States and Great Britain, and studying there the conditions under which the public utilities are provided. Those cities were selected in which the utilities are supplied by municipal plants, and also where they are given by private companies. The committee of investigation of the commission was composed of twenty-one members. This commission made exhaustive investigations of these public and private operations, of the four leading public utilities—gas, water, electric lighting and power, and street railways—in all the cities visited. Fifteen members of this commission sailed for Europe during May of last year, returning in August. These members visited Glasgow, Newcastle on the Thames, London, Liverpool, Norwich, Manchester, Birmingham, Dublin, Leicester, and Sheffield. Investigations in this country were made in Cleveland, Chicago, Philadelphia, Wheeling, Detroit, Indianapolis, Richmond, Atlanta, South Norwalk, Syracuse, Allegheny, New Haven, and Hartford. A staff of engineers, accountants, and statisticians, numbering over twenty, was employed to examine thoroughly every place visited. These experts were so chosen that in each examination made, both sides of the municipal ownership question were represented; thus one engineer, accountant or statistician approached the subject under consideration favorably disposed towards municipal ownership, while his colleague approached his task with views in opposition.

This commission has completed its work, and has made public a number of reports of its inspection. Two reports on labor and politics have been made; one by Professor John R. Commons, of the University of Wisconsin, and the other by J. W. Sullivan, editor of the *Clothing Trades Bulletin,* New York.

Professor Commons finds the conditions under municipal ownership on the whole favorable, and says that the operation of the public utilities by private companies does not remove them from politics. A company in carrying out its contracts must secure its franchises and all privileges from the municipal authorities, and it is just as much a political question to get and keep honest or business-like municipal officials, who will drive good bargains with private companies, on behalf of the public, and then see that the bargains are lived up to, as it is to get similar officials to operate a municipal plant.

Mr. Sullivan sums up his observations with the conclusion that in all the most poorly paid forms of labor, municipalization has not raised the wages or improved the working conditions of the employés above the conditions of the private undertakings. He says that the testimony, as to practical rottenness, root and branch, in certain cities, is conclusive; although these particular plants were selected as models by those representing municipalization on the commission.

The report of the committee on public ownership in the United States has also been made public. This committee consisted of four members: Walton Clark, vice-president of the United Gas Improvement Company, of Philadelphia; Charles L. Edgar, president of the Edison Electric Illuminating Company, of Boston; Professor Frank Parsons, president of the Public Ownership League; and Edward W. Bemis, superintendent of the Cleveland Water Works.

Two reports have been submitted. The first was prepared by Messrs. Clark and Edgar, and finds little to praise in municipal ownership. It says that where municipal ownership has been removed from the realm of philosophical discussion, and put to the test of actual experience, it has failed ingloriously.

Messrs. Parsons and Bemis, on the other hand, take a hopeful view of the municipal ownership question, and declare that the failures of municipal operations are insignificant as compared with the failures of private ownership, either in number or importance.

Messrs. Clark and Edgar, taking up in detail the American municipal electrical plants, report that those examined are mostly inefficient, and equipped with obsolete machinery. They also criticize the method of keeping accounts. In some cases it is said that the management is inefficient, as there are unnecessary employés.

The reports on municipal ownership in British municipalities were prepared by Milo R. Maltbie, Walton Clark, and Charles L. Edgar.

Mr. Maltbie takes a view favorable to municipal operation. He says that it is past the experimental stage in Great Britain, and he declares that the gas and electric plants operated by municipalities in general give a superior service, at relatively lower cost, if compared with privately owned companies. This condition he finds to be due principally to the high rate of interest provided and the greater amount of liabilities of the private companies.

Mr. Maltbie also concludes that actual ownership and operation is not necessary for the success of the municipal ownership idea; that the power to operate, if necessary or desirable, in many instances has been as effective as actual operation.

Messrs. Clark and Edgar favor some form of regulation of private companies rather than the adoption of the municipal ownership idea. They declare it to be plainly proved that municipal ownership is productive of many and serious ills, with little or no compensating good. They believe that the solving of present difficulties is to be found, not in municipal ownership and operation of public utilities, but in the election of municipal officers who will protect the governed against injustice on the part of individuals or corporations.

The reviews of the British tramway systems are presented by William J. Clark and Professor Frank Parsons. Mr. Clark compares the tramway system of Great Britain with the private enterprises of the United States, much to the advantage of the latter. He declares that the latter give better service, and that lines are being extended with greater rapidity. This he attributes to the absence of restriction in the United States as compared with Great Britain, and he says that the difference of rate of fare in the two countries is more than offset by the greater number of free transfers and the longer rides given by the American systems. Mr. Clark also believes that the private companies in Great Britain give a superior service as compared to the municipally operated lines.

Professor Parsons, on the other hand, expresses the opinion that municipal ownership of the British tramway systems has been a success from every point of view. He says that the municipalities were the first to show a progressive spirit in changing from horse cars to the electric system; that the lines have been well managed, the service improved, and the fares have been lower.

Taking up the question more in detail, Mr. Clark says that in the United States there is a mile of track to each 1,516 of town and city population. In Great Britain there is one mile of track to every 12,476 people in town and city. In Great Britain there is one car for each 3,760 population, and in the United States one car to 504 city residents. In the United States, the average time of operation is

eighteen hours a day, with all-night service in the larger cities, while in Great Britain the average time is fifteen hours, and no all-night service.

Professor Parsons, summing up the situation more specifically, says that the rate of reduction on fares has been from nine to thirty times as great during municipal operation as when the roads were operated by private companies. He says that with the exception of Liverpool, all cities having the municipal system have a one-cent fare for short distances, but none of the private companies have a lower fare than two cents for the ordinary passenger. He says that the service is good according to British standards, and in some cases excellent even according to the American standards. Although the speed of the cars is low, this is due to the government restriction. He says that the results of municipal operation are shown in an increase of political efficiency, as well as economical efficiency; that it adds a new field for civic activities and the development of civic interests, and models the habit of thought and action on which all good citizens depend.

Nebraska Electrical Association Organized.

Nebraska central station men held a meeting at the Lincoln hotel, Lincoln, Neb., on July 15, and perfected the organization of the Nebraska Electrical Association. The purpose of this association is to further the interests of its members. The membership is by companies and any employé of a company can represent it at the meetings, which are to be held once a year. This organization was originated by Omaha men and allows as members only electrical supply men and electric light and power companies.

F. A. Nash was chosen temporary chairman. The officers elected for the ensuing year are as follows: T. H. Fritts, of Grand Island, president; R. D. Russell, of Fairbury, vice-president; William Bradford, of Lincoln, secretary; E. V. Capps, of Blair, treasurer; E. A. Bullock, of Norfolk, L. J. Schwingel, of Holdrege, and J. E. Crawford, of Ord, executive committee.

After adopting a constitution, the following papers were read: "Domestic Electrical Appliances," E. L. Callahan; "Nernst Lamps," G. A. Hayes; "Steam Plants," Mr. Johnson.

In the evening an informal banquet was given by the supply men.

The following firms signed the by-laws as members:

Grand Island Electric Company—T. H. Fritts, manager.

Ashland Light, Mill and Power Company—F. E. White, secretary.

Electric Service Company (Wymore)—E. J. Sullivan, treasurer.

Fairbury Light and Water Company—R. D. Russell, superintendent.

York Gas and Electric Company—Joel M. Roberts, president and manager.

Lincoln Gas and Electric Light Company—Homer Honeywell, general manager.

Fremont Gas and Electric Light Company—Homer Honeywell.

Norfolk Electric Light and Power Company—E. A. Bullock, president.

Geneva Electric Company—G. D. Skinkle, manager.

McCook Electric Light Company—A. R. Scott, manager.

Holdrege Lighting Company—L. J. Schwingel, manager.

Auburn Mutual Lighting and Power Company—C. A. Snider, manager.

Beatrice Electric Company—L. E. Watson, manager.

The Water and Light Company, Nebraska City—B. P. Egan, manager.

Omaha Electric Light and Power Company—F. A. Nash, president.

Associate members:

Nebraska Electric Company—A. G. Munro, secretary.

General Electric Company—C. A. Mann.

Nebraska Nernst Company—G. A. Hayes, manager.

Buckeye Electric Company—L. P. Sawyer, secretary and treasurer.

Fort Wayne Electric Works—F. S. Wiemeyer.

In addition to these a number of companies have signified their willingness to become members at an early date.

Those in attendance at the meeting were: F. A. Nash, Omaha; H. Honeywell, B. C. Adams, William Bradford, T. B. Mitchell, M. L. Scudder, F. H. Brooks, E. A. Eames, Lincoln; L. C. Watson, Mr. Johnson, Beatrice; E. A. Bullock, Norfolk; C. A. Snider, Auburn; F. E. White, Ashland; L. J. Schwingel, Holdrege; T. H. Fritts, Grand Island; R. D. Russell, Fairbury; B. P. Egan, Nebraska City; G. F. Skinkle, Geneva; J. M. Roberts, York; A. R. Scott, McCook; C. A. Mann, E. L. Callahan, General Electric Company; A. G. Munro, E. J. Sullivan, Nebraska Electric Company; G. A. Hayes, Nebraska Nernst Company; F. S. Wiemeyer, Fort Wayne Electric Works; L. P. Sawyer, Buckeye Electric Company.

The next meeting of the association will be held at Omaha, Neb., June, 1908.

Ohio Electric Light Association.

The thirteenth annual convention of the Ohio Electric Light Association will be held at Toledo, August 20, 21 and 22. The headquarters will be at the New Boody Hotel. The following programme has been prepared:

Monday, August 19, 5 P. M.—Meeting of all committees for organization and work; theatre party at Casino.

Tuesday, August 20, First session, 10 A. M.—President's address, by W. P. Engle; papers on "Factory Lighting," by A. P. Biggs and J. Kermode; report of Committee on Uniform Accounting. Second session, 2 P. M.—"Luminous Arcs from the Standpoint of Central Station Operation," by H. P. Grabhill; report of Committee on Electric Heating Devices; executive session.

Entertainment—A ladies' prize contest will be held and at 4 P. M. the association and all attending will take cars to Toledo Beach. Supper will be served at the beach, after which there will be dancing.

Wednesday, August 21, First session, 9.30 A. M.—"Cooperative Commercialism in the Electrical Field," by J. Robert Crouse; "The Best Form of Power for Stations of 500-Kilowatt Capacity or Less," by Professor F. C. Caldwell. Second session, 2 P. M.—Report of Committee on High-Efficiency Lighting Units; papers on "Helps to a Solicitor," by Frank Maunsell, J. D. Kenyon and A. S. Miller; report of Committee on Cost Determinations; executive session.

Entertainment—In the forenoon a ladies' card party will be held and in the afternoon the ladies will contest for prizes. For the evening the association has chartered the steamer Greyhound for a trip on Lake Erie. Music, dancing and contests will be some of the attractions of the trip.

Thursday, August 22, First session, 9.30 A. M.—Papers on "Best Ways to Meet Gas and Gasolene Competition," by F. H. Golding, Samuel Rust, W. E. Russell, Arthur Pomeroy, E. T. Selig and W. C. Anderson; report of secretary and treasurer; election of officers; question box; executive session. In the forenoon the ladies will again contest for prizes and in the afternoon places of interest will be visited.

Ohio Independent Telephone Associtaion.

A special meeting of the Ohio Independent Telephone Association will be held at the Southern Hotel, Columbus, Ohio, on August 6, to discuss the general telephone situation in the state.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.

REPORT OF THE BOARD OF DIRECTORS TO THE STOCKHOLDERS.

The annual report of the board of directors of the Westinghouse Electric and Manufacturing Company for the year ended March 31, 1907, was presented at the meeting of the stockholders on July 24, and is given quite fully below. Mr. Westinghouse first called attention to the excellent reports of the vice-presidents and treasurer, and said:

Your company is the possessor of a large number of patents and of licenses under a still greater number by virtue of an agreement with the General Electric Company, made March 31, 1896. It may be said that these patents and licenses are the very foundation of the business of both companies. Their cost can not be computed, because in addition to the large sums paid in cash, the development of the apparatus and systems covered by them have involved manufacturing, engineering and legal expenses which have been constantly charged to current operations.

The active patents of the two companies to-day, by purchase and as the result of development in their factories, greatly exceed the number covered by the patent agreement of 1906, and their value is even greater in proportion because of the enormous increase of the business protected.

Almost every detail of the entire product of both companies is dependent upon the use of some one or more of the many thousand patents jointly owned, the right of use of which should be worth an average of at least ten per cent on the value of the apparatus manufactured and sold under their protection. If this right of use be computed at only three per cent, a figure neither company could afford to accept from other manufacturers, the aggregate annual worth of these patents would be $3,000,000 on the present output of the two companies, which, if capitalized on a ten per cent basis would make a gross value of $30,000,000 for all of the patents of both companies.

Your directors on September 20, 1906, authorized the sale of 100,000 shares ($5,000,000 par value) of additional stock at seventy-five dollars per share. Thirty-three thousand and sixty-six shares were subscribed for in response to the offering made to stockholders April 25, leaving a balance of 66,934 shares, which the proper officers of the company are authorized to sell from time to time at a price of not less than seventy-five dollars per share. When the amount so authorized is disposed of the outstanding capital stock of your company will be $30,000,000.

The $6,000,000 of collateral trust notes falling due August 1, 1907, have been provided for by the authorization by your directors of a new issue of $6,000,000 six per cent three-year notes, the sale of which has been negotiated and the proceeds of which will be used for the retirement of the notes falling due August 1, 1907. Under the arrangement effected at the time the first issue of notes was created, the Security Investment Company is purchasing from your company at thirty dollars per share the 30,000 shares of the capital stock of the Lackawanna & Wyoming Valley Rapid Transit Company, received by your company as a bonus, the proceeds of which provide for all of the costs in connection with the issue and sale of these notes.

All of the shares of the Westinghouse Electric Company, Limited, are owned by your company and through its organization many of the foreign operations of your company are conducted, the Westinghouse Electric Company, Limited, being interested, either as trustee or owner of large interests in the following European Westinghouse companies: the British Westinghouse Electric and Manufacturing Company, Limited, England; Société Anonyme Westinghouse, France; Societa Italiana Westinghouse, Italy; Societe Electrique Westinghouse De Russie; Westinghouse Metallfaden Glühlampenfabrik G. m. c. H., Austria.

Under the able management of Mr. Newcomb Carlton, one of your vice-presidents and managing director of the British Westinghouse Company, the business of that company is being established upon a sound and profitable basis. The orders received for its fiscal year to end the thirty-first of July will exceed $6,000,000. The operations of the Société Anonyme Westinghouse (the French Westinghouse Company) under the able management of Mr. F. E. Drake, director general, have during the past year assumed very substantial importance, especially by reason of contracts entered into with the Italian government for the installation of electrical apparatus for the operation of one of the Italian state railways. This contract has required the organization by the French Westinghouse Company of an Italian Company (The Societa Italiana Westinghouse) and the establishment of works at Vado near Genoa, Italy, which are now so far advanced that manufacturing operations have been inaugurated under the direction of a competent staff of officials.

The Societe Electrique Westinghouse De Russie is a French company organized for the purpose of carrying on business in Russia, for which purpose it has been granted a license by the Russian government. This company is now completing the execution of a contract amounting to nearly $5,000,000 covering the electrification of a part of the tramway system of St. Petersburg and is also carrying on a growing manufacturing business in its works at Moscow.

The Westinghouse Metallfaden Glühlampen-fabrik G. m. c. H. has recently been organized and works have been erected near Vienna, Austria, for the manufacture of tungsten incandescent lamps.

The operations of these several companies are on a more satisfactory basis than heretofore with indications that the returns to your company will, in the not distant future, fully justify the expenditures which have been made.

In addition to the above-named European companies, your company is largely interested in the Canadian Westinghouse Company, Limited, the works of which are located at Hamilton, Ontario. This company is doing a large and constantly increasing business and its prosperity is indicated by the payment of regular quarterly dividends of one and one-half per cent and the accumulation of a substantial surplus.

Congress and numerous states have enacted laws prohibiting combinations in restraint of trade. Some of these laws, intended to afford public protection, contain features of an onerous character and give rise to difficulties in the general conduct of business. It has been the especial concern of your officials to avoid infraction of these statutes. Independently of the laws referred to your managers have been opposed to all combinations of every character having for their object an interference with the right of others.

In conclusion, your directors desire to express to the stockholders their high appreciation of the faithful services rendered by all of the officials and agents of the company.

THE MANUFACTURING DEPARTMENT.

E. M. Herr, first vice-president, reports as follows for the manufacturing department:

The most notable development was in the broadening and extending of the scope of our single-phase system, invented, developed and promoted by this company. The cost of this, as of all other developments, has been charged to expense.

It is fortunate for our industry that the steam railroads are moving with deliberation in the matter of electrification, not only that the best types for given conditions shall be determined upon, but owing also to the fact that were the business to come at once in any considerable volume, our facilities would be unequal to cope with the demand, occupied so fully as they are with already established lines. The very magnitude of the steam railway field will involve a great amount of business even if the railroads go about the work of electrification slowly.

Notwithstanding the liberal additions to the manufacturing plant provided prior to last year, all of which were completed and fully equipped, the business has further increased, calling so urgently for still more facilities for the manufacture of certain kinds of products that a new building, containing nearly 250,000 square feet of floor space, was not only authorized, but is at the present time rapidly nearing completion. This will provide an increase of upwards of ten per cent to the manufacturing floor space at the East Pittsburg works, and will afford a much needed addition to our principal plant.

The number of employés, exclusive of the selling organizations, at the close of the fiscal year, March 31, 1907, was 18,-

386, an increase of 3,681 since the close of the fiscal year 1906.

Early this year it was decided by the management to change the name of one of the subsidiary companies from the Sawyer-Man Electric Company to the Westinghouse Lamp Company, and on April 1 this change went into effect. The new factory of this company at Watsessing, N. J., for the production of incandescent lamps, is now completed and manufacturing has begun with very satisfactory results. This company has acquired the capital stock of the Westinghouse Metal Filament Incandescent Lamp Company, Limited, of Vienna, Austria, the original owners of the tungsten lamp patents. The development of this remarkably efficient lamp is engaging our best attention. The filament, as yet, is delicate, and while satisfactory progress has been made, additional improvement is necessary to entire commercial success.

The addition to the Bryant and Perkins works, referred to in the last annual report, was completed early enough to supply a necessary increase in the capacity of these works during the winter and spring months.

An extension of the factory buildings occupied by the R. D. Nuttall Company is in progress and will greatly increase its manufacturing capacity, affording much needed addition to the facilities required by its rapidly growing business.

Although much of last year's work was done under conditions requiring extra exertions by the officers and employés, it is a pleasure to commend all concerned for their faithful, loyal and intelligent efforts for the company's welfare.

ENGINEERING AND SALES.

L. A. Osborne, second vice-president, reports as follows for the engineering and sales departments:

Marked improvement has followed our efforts at simplifying and organizing the work of the engineering department and at no previous time in the history of the company have the orders been so satisfactorily handled or at so low a cost per order.

Advances have been made during the year by our engineers in the design of generators for direct connection to steam turbines. A number of machines of 7,500 kilowatts capacity have been made and put into operation and there are now being constructed several of 10,000 kilowatts capacity. A gratifying measure of success has followed our efforts in this field and a force of our designers are constantly engaged in this important work.

One of the most striking successes which has followed the work of our engineers during the past year relates to the development of the so-called Metallic Flame Arc Lamp. This new form of illuminant has been tested in commercial operation and has met with the evidence of warm appreciation by engineers and central stations generally. It seems impossible for the older forms of carbon lamps for outdoor illumination to successfully hold their own in the face of this latest advance in the art.

During the year we have taken a license from the Cooper Hewitt Electric Company, by which, under terms favorable to our company, we are entitled to manufacture and sell the mercury vapor rectifier, for which we anticipate a rapidly growing demand. Our engineers are giving a close study to the phenomena exhibited by this device and we expect to largely extend the scope of its application.

The Westinghouse Lamp Company has begun to market the new form of incandescent lamp, known as the Metallized Filament Lamp, which marks a considerable step in advance in electric illuminants of the vacuum type.

It is impossible to enumerate in detail the manifold activities of our engineering department, although such a recital would be of great interest. In accord with our traditional policy, the aim of our engineers is to design apparatus of superior quality and of as low a cost as is consistent with the maintenance of the highest possible standard.

The following table shows the orders

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY AND SUBSIDIARY MANUFACTURING COMPANIES.

CONSOLIDATED GENERAL BALANCE SHEET, MARCH 31, 1907.

ASSETS.		
Property and Plants:		
Factory plants, including real estate, buildings, machinery and equipment		$12,570,073.15
Quick Assets:		
Cash	$1,383,891.95	
Accounts and notes receivable	10,443,116.96	
Raw materials and supplies at purchase prices and finished parts and completed apparatus and work in progress, at factory costs.	16,988,176.51	
Completed apparatus, at factory costs, on consignment at district sales offices and other places, for resale	1,468,513.34	
		30,283,698.76
Investments:		
Stocks and bonds of Lackawanna & Wyoming Valley Rapid Transit Company	$6,300,000.00	
Stocks and bonds of other companies, including foreign companies operating manufacturing plants in Canada, England, France and Russia, and selling companies with valuable patent rights in Germany, China, Japan and other foreign countries	15,996,806.59	
		22,296,806.59
Other Assets:		
Charters, franchises, patents, office furniture and fixtures at factory plants and district sales offices, insurance and taxes paid in advance, etc.		7,120,276.09
Total assets		$72,270,854.59
LIABILITIES.		
Capital Stock:		
Preferred	$3,998,700.00	
Assenting	20,996,350.00	
Non-assenting	1,100.00	
		$24,996,150.00
Funded Debt:		
Convertible sinking fund 5 per cent gold bonds	$15,000,000.00	
Debenture certificates	2,278,000.00	
		17,278,000.00
Collateral Notes		6,000,000.00
Current Liabilities:		
Current notes	$8,703,448.57	
Current accounts	2,167,218.36	
Interest, rebates and allowances, taxes, etc., accrued, not due	351,223.63	
		11,221,890.56
Reserves:		
For inventory adjustment, etc.		179,662.36
*Profit and loss—surplus		12,595,151.67
Total liabilities		$72,270,854.59

NOTE—This company has a contingent liability, as guarantor, of $850,000.00 bonds of the Walker Company due 1916 secured by mortgage on the property and plant of the Walker Foundry Company, Cleveland, Ohio. Also, as endorsers, for notes receivable discounted, amounting to $996,888.61.

*Subject to dividend declared March 20, 1907, payable April 10, 1907.

CONSOLIDATED STATEMENT OF INCOME AND PROFIT AND LOSS FOR YEAR ENDED MARCH 31, 1907.

Gross Earnings:		
Shipments billed		$33,026,240.35
Cost of Shipments:		
Factory costs, including all expenditures, aggregating $1,254,706.60 for patterns, dies, new small tools and other betterments and extensions. Also inventory adjustments and all selling, administration and general expenses		28,846,665.05
Net manufacturing profits		$4,179,575.30
Other Income:		
Interest and discount	$190,462.79	
Dividends and interest on sundry stocks and bonds owned	503,041.11	
Miscellaneous—royalties, etc.	562,831.01	
		1,256,334.91
Total income		$5,435,910.21
Deductions from income:		
Interest on bonds and debentures	$827,887.85	
Interest and discount	764,464.84	
Tax on capital stock, premiums on debentures retired, etc.	46,249.92	
Property and plant depreciations, accounts and notes receivable and other assets written off	900,637.29	
Miscellaneous	128,706.55	
		2,667,946.45
Net income—surplus		$2,767,963.76
Other Profit and Loss Credits:		
Profit and loss surplus, March 31, 1906	$12,562,507.24	
Profit on sale of Garrison Alley property, Pittsburg, Pa.	84,205.00	
		12,646,712.24
Gross surplus		$15,414,676.00
Profit and Loss Charges:		
Stocks and bonds depreciated	$223,186.56	
Damage by flood	46,820.01	
Miscellaneous—applicable to prior years—net	49,962.76	
Dividends paid	2,499,555.00	
		2,819,524.33
Surplus March 31, 1907, per balance sheet		$12,595,151.67

taken by the company for the fiscal years 1900-1 to 1906-7, both inclusive:

April 1, 1900 to March 31, 1901	$12,516,071.86
April 1, 1901 to March 31, 1902	17,927,339.43
April 1, 1902 to March 31, 1903	19,571,294.91
April 1, 1903 to March 31, 1904	18,5 9,614.21
April 1, 1904 to March 31, 1905	16,570,717.13
April 1, 1905 to March 31, 1906	24,939,602.35
April 1, 1906 to March 31, 1907	34,175,548.00

The above table does not include the orders of the Bryant and Perkins companies, the R. D. Nuttall Company, or the Sawyer-Man Electric Company (now the Westinghouse Lamp Company,) which for the fiscal year 1906-7 amount to four million seventy-five thousand six hundred seventy-one dollars ($4,075,671.00).

There are on the rolls of the sales department as of March 31, 1907, five hundred and eighty-three (583) employés, being an increase over March 31, 1906, of one hundred and fifty-four (154) employés.

We now have twenty-three (23) district and fourteen (14) subsidiary offices, at which the company maintains resident representatives.

During the past year we have perfected arrangements for the more wide-spread disposition of our products to export countries, working in close cooperation and harmony with our foreign affiliated companies. By these arrangements a more vigorous campaign has been inaugurated, which has already shown gratifying results. We have established permanent representatives in a number of the more important South American cities and have perfected a plan by which in the future our company will be adequately represented in many new foreign localities.

In conclusion I desire to especially commend the high degree of intelligence displayed by the employés of the departments under my direction and the single-hearted loyalty which has been evidenced by them in the discharge of their duties.

CONSOLIDATED GENERAL BALANCE SHEET.

T. W. Siemon, treasurer, and James C. Bennett, general auditor, report as follows in regard to the company's financial operations:

The operations of our subsidiary manufacturing companies being now recorded by a system of accounting similar to that of the Westinghouse Electric and Manufacturing Company, we are enabled to fully set forth the combined operations and income of the company.

Following the established practice of the company, all expenditures during the year for new patterns and dies, new small tools and other betterments and extensions have been deducted in arriving at the net manufacturing profits. These expenditures during the year ended March 31, 1907, amounted to $1,254,706.60 and for five years ended that date aggregated over $5,500,000. The cost of all experimental work is charged each month against manufacturing profits. This cost for the year ended March 31, 1907, amounted to $236,364.97 and for five years ended that date aggregated $793,166.41. Depreciations of property and plant, accounts and bills receivable and other assets made prior to closing the books for the fiscal year, amounted to $1,029,343.84 for the year ended March 31, 1907. During the five years ended March 31, 1907, these depreciations aggregated $5,831,742.93. The total of all charges to depreciations and of the deductions from manufacturing profits for renewals, extensions, betterments and experimental and development work during the five years ended March 31, 1907, amounted to over $12,000,000.

For many years the product of the company has been sold on a cash basis. Losses from bad debts averaged about one-tenth of one per cent for the past five years.

It has been the policy of the company not to involve itself directly or indirectly in any underwritings or in the taking of securities as part payment for apparatus supplied, except only when such securities could be promptly converted into cash.

The following is the consolidated, condensed statement of income of the company and its subsidiary companies for April and May, the first two months of the present fiscal year:

Manufacturing profits and other income	$1,377,765.79
Deductons: depreciations of all kinds, inteeist on bonds, etc	528,301 78
Surplrus (at rate of 20 per cent on capital stock)	$849,464.01

The officers and department heads of the Westinghouse Electric and Manufacturing Company are as follows:

Officers: Brayton Ives, chairman of board, New York; George Westinghouse, president, Pittsburg; E. M. Herr, first vice-president, Pittsburg; L. A. Osborne, second vice-president, Pittsburg; Newcomb Carlton, fourth vice-president, New York; G. W. Hebard, acting vice-president, New York; W. M. McFarland, acting vice-president, Pittsburg; Charles A. Terry, secretary, New York; T. W. Siemon, treasurer, New York; H. F. Baetz, assistant treasurer, Pittsburg; E. St. John, assistant treasurer, New York; James C. Bennett, general auditor, Pittsburg; F. E. Craig, assistant auditor, Pittsburg; W. B. Covil, Jr., assistant auditor, Pittsburg.

Board of Directors—A. N. Brady, New York; N. Willis Bumstead, Boston; George W. Hebard, New York; E. M. Herr, Pittsburg; Brayton Ives, New York; George C. Smith, Pittsburg; T. W. Siemon, New York; Frank H. Taylor, New York; W. D. Uptegraff, Pittsburg; George Westinghouse, Pittsburg; H. H. Westinghouse, New York.

Manufacturing Department—Alexander Taylor, manager of works; F. W. Cox, assistant manager of works; J. H. Zimmerman, assistant manager of works; R. A. Smart, assistant manager of works.

Engineering Department—B. G. Lamme, chief engineer; H. P. Davis, assistant chief engineer; C. F. Scott, consulting engineer.

Sales Department—C. S. Cook, manager railway and lighting department; S. L. Nicholson, manager industrial and power department; C. B. Humphrey, manager detail and supply department; Maurice Coster, manager export department.

A New Color Meter.

An instrument devised to enable definite figures to be assigned to the colors of objects has been designed by F. E. Ives. It consists in comparing the color of the object under test with a color band, which is formed by mixing in the required proportions the three primary colors—red, green and blue—obtained by means of a defraction grating. This instrument is described in the *Journal of the Franklin Institute* for July. It consists of a portable telescope with an objective lens which forms an image of the object to be tested within the telescope, the light for this purpose being admitted through a narrow slit. At the same end of the instrument are three other slits properly spaced so that each of them by falling upon the grating will give rise to a ray of light of a definite color which will be seen through the eye-piece of the instrument. By means of slides and adjusting screws, the width of each of these slits may be varied at will, thus varying the intensity of the corresponding ray of colored light. This portion of the instrument is separated from that through which the light directed from the object being examined is admitted. Within the instrument the defraction grating is arranged so that the direct ray from the object passes above it, while the other three beams fall upon the grating and are there defracted, producing the three primary colors, as mentioned. When in use the instrument is directed at the object to be examined, and a pure white screen is held in front of the three color slits. By this means pure white rays are admitted through the three slits. The width of these slits is then varied, thus admitting more or less red, green or blue light, as may be necessary, until the color of the band thus formed is judged to be equal and the same as that of the object under test. By scales on the adjustment screws the position of each of the color slit slides is read off, and these give on an arbitrary scale the value of the color. Knowing these figures, this color can be reproduced exactly at any time, and definite colors may thus be selected, although samples for comparison may not be at hand.

The apparatus would seem to offer a convenient method for determining the quality of light as given by different sources. For this purpose, however, it is necessary, of course, that the illumination of the background should be secured from some known standard. For transparent objects nothing could be better than a sky background when it is rainy or foggy.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

Electric versus Hydraulic Elevators

In this discussion of the relative advantages of hydraulic and electric elevators, Percy Good says that if everything be taken into consideration there is, in reality, nothing to choose between the two forms in point of view of safety, provided, of course, the elevators are made by competent firms. The question of convenience is not of such importance. In the case of the electric elevator, various means of control offer themselves, and automatic appliances for preventing accidents are more easily and cheaply fitted than with hydraulic power. The author then refers to curves taken from the proceedings of the Institution of Civil Engineers, of Great Britain, showing the relative costs of operating hydraulic and electric elevators. It is a fact that the cost of running an electric elevator is always less than one of the hydraulic type, if power for both be purchased from a power company. Where there is but one elevator, the cost of hydraulic power is shown from these curves to be about $40; electric power, about $15. The latter cost is figured at the rate of five cents per kilowatt-hour, but if the rate were taken as two cents a kilowatt-hour, the cost would be reduced to $6 for the electric elevator. If there are several elevators in the same building, the charges for water power are reduced to fifty cents a thousand gallons. The figures then are $20 for the hydraulic elevator, and $6 for the electric. The author quotes Sir William Preece as saying that the London post-office has found that the relative costs of working electric and hydraulic elevators are as one to five. The post-office has its own power plant, but the cost of power is not less than two cents a kilowatt-hour. The author concludes that a careful consideration demonstrates that the electric elevator is just as safe as the hydraulic, much cheaper to use, and much less likely to cause discomfort in the house.—*Abtracted from the Electrical Review (London), July 5.*

On the Loss of Energy in the Dielectric of Condensers and Cables.

In the second section of a study of dielectric losses, Dr. Bruno Monasch describes the difficulties of applying the bridge method, and shows how these may be minimized. One of these is the charging phenomenon in the cross connection. This may be removed by connecting one point of the bridge to the ground. The leakages between different parts of the bridge are avoided by the use of paraffine as an insulator. Capacity effects between parts of the bridge, and between the bridge and earth, were made innocuous by suitably arranging the leads. The capacity of the resistances employed may produce a slight error, which should be made as small as possible by careful construction of these auxiliaries. The most serious difficulties encountered were in the construction of auxiliary condensers suitable for high voltages, the dielectric loss of which could be neglected. It was not very difficult to reduce the loss taking place in the condenser itself sufficiently by choosing an appropriate dielectric. After a number of attempts with oil, air was recognized as the only dielectric suitable for this purpose. Much trouble was caused, however, by the point discharges taking place at the coatings of the condenser at high potentials. This loss was found to increase much more quickly than the square of the voltage, and its appearance could easily be observed by a state of unstability, of continual variation in the adjustment of the bridge. This was overcome by building an air-condenser, which consisted of two brass tubes, one one metre in length, and one ninety-five centimetres long. The outside diameter of the longer was 110 millimetres, and of the shorter, eighty-five. The metal was one millimetre thick. One end of the outer tube was closed by a hemispherical bottom, and then surrounded with a block of paraffine twenty centimetres in height and thirteen in diameter. The inner tube was closed by hemispheres on both ends, and on one end a brass rod was soldered, provided with a screw thread at its free end for fastening the tube. This tube was suspended concentrically within the larger tube, its position being adjusted by means of the rod. All edges were carefully avoided in the construction of the apparatus, the upper end of the outer tube being beaded over. The maximum capacity of the condenser amounted to 0.00023 microfarad, the inner tube being entirely within. This could be varied continuously by withdrawing the inner tube. The author could not detect any loss in this condenser, although tested repeatedly in various ways. The indicating instrument employed was an optical telephone, first adjusted for eighty-six vibrations a second, and later tuned to fifty. With this device tests were made on a number of samples of cable of commercial types, the first test being to detect any influence of wave-form upon the performance of the test set. It was found that the indications of the telephone were independent of the wave-form. From this it is concluded that an effect of the upper harmonics on the dielectric loss due to the fundamental component, conceivable, but not very probable, does not take place. Voltage tests were then made on these cables. The results of these show the strict validity of the square law for the dielectric loss in all of the dielectrics tested. The author concludes, therefore, that by means of this method it is unnecessary to conduct tests at high voltages. This is an advantage, since at low voltages large auxiliary condensers may be employed, and thus sources of error avoided. This also makes it possible to obtain accurate quantitative information respecting the loss in a dielectric. The samples of cable tested were insulated with various materials, including impregnated paper, rubber and impregnated jute.—*Abstracted from the Electrician (London), July 5.*

Nickel Alloys.

Certain of the nickel alloys are used to a considerable extent in the manufacture of electrical instruments. In this article A. H. Sexton gives an interesting account of the most common of the alloys of nickel, and explains the common uses made of them. Nickel is one of the comparatively rare metals, and only recently has it come into wide use. It has been cheapened by the discovery of new sources of supply, and by improvements in the methods of production. It is white in color, malleable and ductile, and closely resembles iron in all its properties, with one exception of great practical importance: it does not rust on exposure to moist air. It is this property which led to its wide use as a protection for iron and other metals which corrode easily. The metal is also

used for the manufacture of small articles where resistance to oxidation is important. Nickel does not cast well in the pure state, as it absorbs carbon monoxide and gives this out on cooling, thus causing blow-holes. This difficulty is overcome by the addition of a small quantity of magnesium—about one-eighth per cent. Aluminum and phosphorous have been suggested for the same purpose. Copper and nickel alloy readily in all proportions. When added to copper it affects the color but slightly. Until the alloy contains about thirty per cent of nickel, the coppery red color is still distinguished, but when the proportion of nickel approaches forty per cent, the alloy becomes silver white, and continues unchanged in color until the nickel reaches about eighty per cent, after which the color darkens considerably. Copper-nickel alloys are rarely used, except for coinage. German silver includes a large number of alloys containing copper, nickel and zinc in different proportions, sometimes with the addition of other metals. These have been used widely for various purposes. One of the advantages of German silver is its white color, which led to its employment in the manufacture of table articles before the introduction of electro-plating. Where a very white color is required, the alloy should contain at least twenty-five per cent of nickel. The addition of zinc cheapens the alloy and lowers the melting point, but enables it to take sharper castings. When iron is added in small quantities, the alloy becomes whiter and harder. Up to two per cent iron has no deteriorating effect, except in regard to hardness and the color. Tin is injurious. Silver has been added in the hope that it would improve the color, but without good results. Cobalt seems to darken the color of the alloy. Tungsten is sometimes added to form an alloy called platenoid, which has a very high resistance and is used for electrical work. The amount of tungsten added is one to two per cent. The most important other alloy of nickel is with iron, in the form known as nickel steel.—*Abstracted from the Mechanical Engineer (London), July 6.*

A Comparison of Street Illuminants.

In view of the keen competition existing between gas and electricity for the illumination of public thoroughfares, it seems, says Kenelm Edgcumbe, that no satisfactory method of comparison has been decided upon. Broadly speaking, two illuminants can be compared either as to candle-power or to the illumination which they produce, and the surface at which the measurement is made may be either at the ground level or at a fixed distance above it. A measurement of the mean spherical candle-power is an accurate means of determining the total light emitted, but it is tedious to determine, and when found, it affords no idea as to the distribution of the light, which is of paramount importance for street illumination. In order to give an even distribution of light, the candle-power should be least in a downward direction, and increase rapidly as the vertical is approached. Above twenty-five degrees from the horizontal the rays are of small value, and all above the horizontal are useless unless reflected. Candle-power curves of the ordinary gas mantle show that it is unsatisfactory in this respect, and reflectors must be used. The electric arc is much better, as are also incandescent lamps, although the latter usually require reflectors to secure satisfactory distribution. The author points out that one of the most important councils of London lets its contracts on terms which require the contractors to furnish lamps giving a minimum of 900 candle-power, as measured by the council's traveling photometer. Such an arrangement might appear to be all in favor of the lighting contractors, since, no angle being specified, they might apparently claim to make the measurements at that which suited them best. As a matter of fact, however, the choice of the angle is determined by the photometer itself, which is moved along the street until a balance is obtained; and this may occur at almost any angle. It was suggested fifteen years ago by A. P. Trotter that the illumination on the surface of the ground should be taken as the true criterion, and he suggested for this the term "candle-feet." This is thought to be the right quantity to measure, if for no other reason than because the end in view is to illuminate a given area. The candle-power of the lamps used is merely a means to that end. Mr. Trotter suggested that measurements should be made as near as possible to the ground, but a height of three feet, six inches, to four feet has become now almost universal, and is perhaps the height at which the majority of objects have to be examined. It is also convenient for making measurements. Some time ago H. T. Harrison suggested that the minimum illumination found in a given street should be regarded as the criterion of the efficiency of the lighting. This was a step in the right direction, but, unfortunately, the photometer Mr. Harrison used had a screen fixed at an angle of forty-five degrees, so that the illumination measured, instead of being the actual minimum, was the minimum due to one lamp at a time on a surface facing it, and inclined at an angle of forty-five degrees to the vertical. The author gives the illumination curves for a number of London streets, and points out that those streets which have the highest average illumination appear to be the best lighted, and not those which have the highest minimum. It seems essential, in order to arrive at a really satisfactory decision regarding the relative merits of different illuminants, to make actual tests on the ground, and from these deduce a figure of merit or illumination efficiency for the conditions under which each is being used. Figures calculated from laboratory tests are of little value, since street lamps do not work under laboratory conditions,, and are necessarily subject to rapid deterioration. For this purpose it is not necessary to obtain contour lines for illumination over an entire street, because the variations in illumination across the street are slight. If measurements are made down the centre of the road, they afford a perfect guide to the general lighting. These, if plotted with the illumination in candle-feet as ordinates and abscissæ in distance, give curves which include an area and give the total amount of illumination furnished the street. As these curves repeat themselves from lamp to lamp, but a short length of the street need be surveyed. From the curves the author deduces a figure of merit, which is the average candle-feet per yard of street under working conditions. From this figure and the cost of operating the light, figures are deduced showing the yearly costs per candle-foot per yard of illumination for a number of London streets where different types of lamp are employed. Seven streets lighted by gas used in different ways show that the cost varies from $3.06 for a high-pressure gas single burner at the Victoria Station, to $19.60 for an intensified two-burner lamp on Fleet street. Flame arcs on Oxford street with two ten-ampere lamps on a post show that the cost per annual candle-foot yard was $2.85. For flame arcs at the Charing Cross Station the cost was $2.45. For ten-ampere open-arc lamps on St. James street it was $4.06. Figures are also computed for the different types of incandescent lamp. That for the tantalum lamp is $5.35; for the Nernst lamp, $6.85; for mercury vapor lamps, $4.25; for an Osram lamp, $6.65; for another tantalum lamp with a different type of reflector, $9.85.—*Abstracted from Electrical Engineering (London), July 4.*

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The "Sirocco" Centrifugal Fan.

Although the "Sirocco" centrifugal fan has been on the market but a few years, the engineering world has recognized its availability, and it has already been accorded a prominent position in notable installations. The fan is built on principles not generally favored in the construction of centrifugal fans, being rather at variance with preconceived ideas and accepted principles. The operation of the fan, however, has demonstrated that the design is correct and that the apparatus is remarkably efficient.

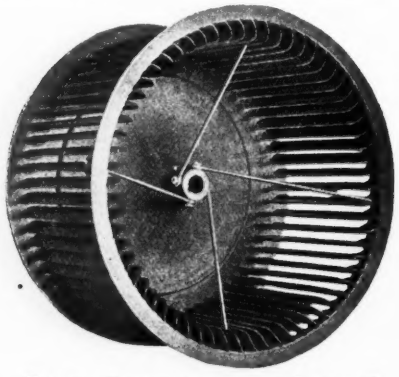


FIG. 1.—CONSTRUCTION OF "SIROCCO" FAN-WHEEL.

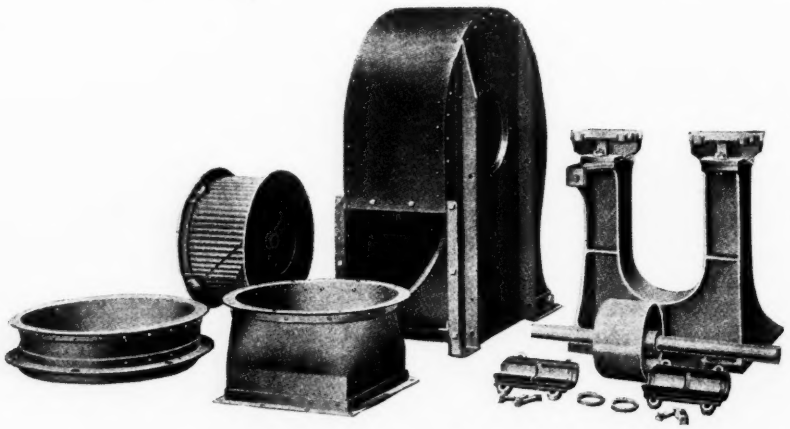


FIG. 2.—PARTS OF "SIROCCO" CENTRIFUGAL FAN.

In centrifugal fans of the ordinary type the blades or vanes are usually of greater length radially than their face measurement parallel with the fan shaft, and usually six to twelve blades are employed. In the "Sirocco" fan the radial measurement of the blades is much less than their face measurement parallel with the fan shaft, and sixty-four blades are ordinarily employed, the tips of the blades being curved forward in the direction of rotation.

Fig. 1 shows the construction of the fan-wheel. There was a tendency to criticize this construction, and the belief was announced that it might be satisfactory for low pressures or free discharge, but would be useless against high-water gauges or with inelastic fluids, such as water. The manufacturer states, however, that the fan acts as efficiently up to thirty-inch water-gauge pressure as at one inch, and that it is just as good a centrifugal pump for water with high or low lifts as it is as a fan for the propulsion of air.

The suction eye of the fan is free from obstruction, while at the same time the construction of the fan-wheel is very rigid, even for high speeds of rotation.

The casing of the fan is of the usual spiral or snail type, constructed of steel plates and angles strongly riveted together. In the smaller sizes the casing (with the exception of the suction eye and discharge mouth-piece) is made in one part and of cast iron. In the larger sizes it is constructed in two parts, the lower and upper halves meeting horizontally at the fan centre. Fig. 2 shows the parts of the "Sirocco" centrifugal fan.

The delivery mouth-piece is detachable, if necessary, and is supplied with either circular, rectangular or évasé form. The smaller sizes are supplied with circular mouth-pieces, while the larger diameters are usually fitted with a square discharge.

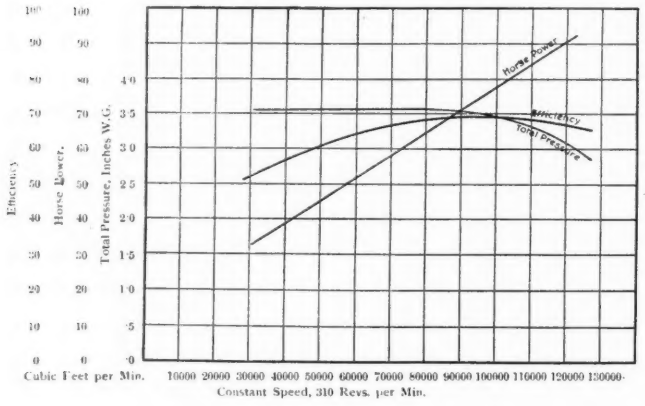


FIG. 3.—PERFORMANCE OF "SIROCCO" FAN AT CONSTANT SPEED.

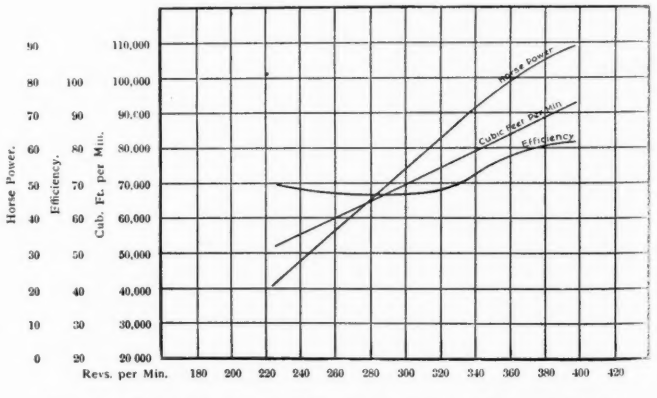


FIG. 4.—PERFORMANCE OF "SIROCCO" FAN AT VARIOUS SPEEDS.

For belt-driven fans the shaft is lubricated by two-ring bearings supported on a cast-iron fork-shaped pedestal. Where the fans have to deal with hot gases, as with induced draft for furnaces, the inner bearing is water-jacketed.

In cases where a single fan has to deal with large volumes of air at a limited speed, a double-inlet fan is employed. This type is practically the same as two single-inlet fans placed back to back, the circular disc attached to the hub being common to both sets of blades.

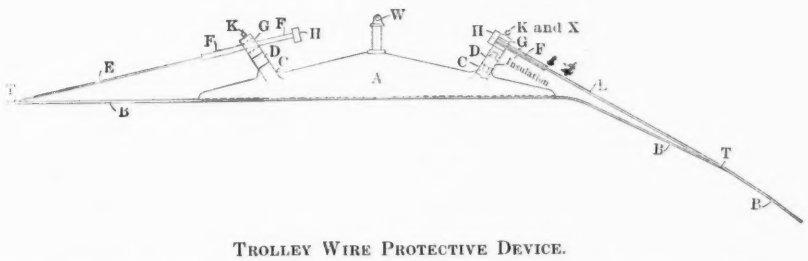
Figs. 3 and 4 show curves indicating the capabilities of a standard "Sirocco" centrifugal fan. These figures, it is stated, were made as an independent test carried out by the authorities of a large electric-lighting corporation.

The applications of the fan are obvious. It may be used for induced draft, forced draft, and as an exhaust fan for the ventilation of buildings and mines, for ship ventilation and for cupolas and forge fires. The fans are made in capacities to move any desired volume of air, installations having been furnished for duties ranging from 150 to 300,000 cubic feet of air per minute.

The Sirocco Engineering Company, with main offices at 138 Cedar street, New York city, has been incorporated to take over the American rights of the manufacturer of the "Sirocco" centrifugal fan, Davidson & Company, Belfast, Ireland. A temporary factory has been established at the Bush Terminal Stores, Brooklyn, N. Y., and in the near future the company will erect a large works in New York state.

A Trolley Wire Protective Device.

George F. Cole, an engineer of Chicago, Ill., has invented a trolley protective device which possesses features of considerable merit. The device is designed to eliminate the danger to pedestrians or traffic which ensues when a charged trolley wire is broken and the ends fall to the street. The accompanying illustration gives a good idea of the principal features of this device. Upon the ear or hanger A, which is suspended from the cross-wire W, attached to the poles on either side of the street, and to which the trolley wire B is connected, two projecting lugs DD are fitted. These lugs are made of insulating material. On the top of the lugs copper contact pieces KK are secured. From these contact pieces a wire X is carried to an automatic switch upon a section of the main feeder cable. These feeder sections are from one-half to three-quarters of a mile in length.



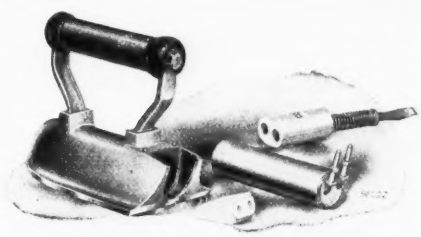
Trolley Wire Protective Device.

Through elongated poles passing through the insulated lugs DD are carried wires EE, connecting at an angle with the main trolley wire at TT. These auxiliary wires terminate in contact heads HH.

When the trolley wire is up and in normal position the contact heads HH are separated from the contact pieces KK. When the trolley wire breaks the auxiliary wires draws the heads HH against the contact pieces, bringing them together and closing a circuit by the wire X and the automatic switch upon the sectional feeder cable, opening this circuit and rendering the trolley wire dead. The sleeve F on the auxiliary wire E is for the purpose of stiffening the wire at this point.

The General Electric Company Flat-Iron.

The accompanying illustration shows the part of a six-pound electric flat-iron manufactured by the General Electric Company, Schenectady, N. Y. This includes the cartridge-type heating unit used in all General Electric flat-irons. This unit consists of an edgewise-wound spiral of special resistance ribbon, insulated between turns and enclosed in a mica-lined copper cylinder. The iron may be left idle on the circuit indefinitely without burning out, and the unit is practically indestructible. When renewals are necessary, however, the cartridge unit can be removed and replaced with no trouble whatever.



General Electric Six-Pound Electric Flat-Iron with Heating Unit Removed.

In designing the General Electric flat-irons special care has been given to the shape. Stove-heated iron must store up heat, and are necessarily solid masses of metal. Where the heat is generated in the iron itself, storage capacity is unnecessary, and the energy, instead of heating a large mass of metal, is available for useful work. The General Electric irons are so shaped as to facilitate the flow of heat to the working surface, at the same time giving sufficient radiating surface to prevent overheating if accidentally left standing idle on the circuit.

The General Electric Company's line of flat-irons includes traveler's iron, ordinary laundry iron, tailor's heavy electric irons and special irons. The traveler's iron weighs three pounds, takes 250 watts, and may be attached to any lighting socket. It gives sufficient heat for all light pressing, such as is required on light dress goods, ribbons, laces, shirt-waists, etc. The domestic iron, which has just been described, weighs six pounds and takes 500 watts. The laundry iron also weighs six pounds and takes 500 watts. An eight-pound, 600-watt iron is made for heavy laundry work. The tailor's irons are made up in twelve-pound, fifteen-pound, eighteen-pound and twenty-four-pound weights, taking from 700 to 800 watts.

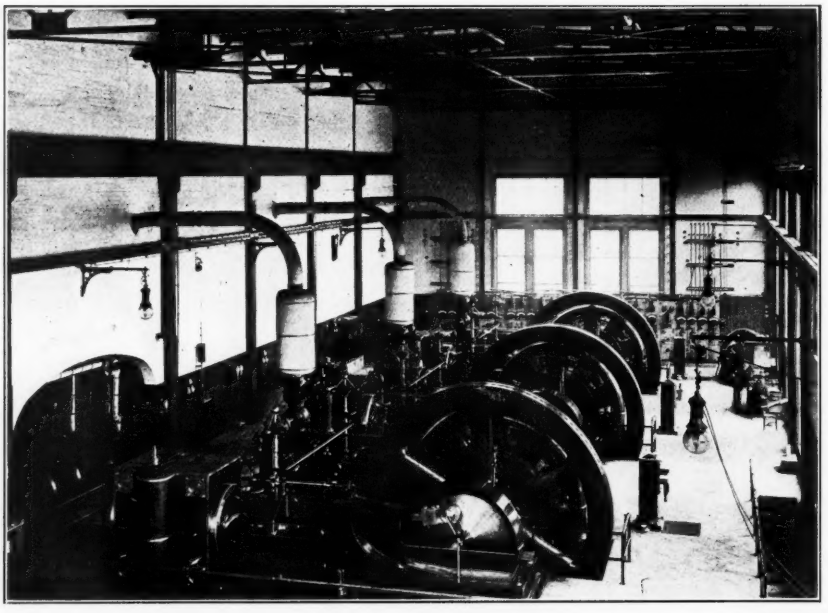
Where none of the standard irons meets the requirements of an individual case, a special design will be made for customers wishing a number of irons. The company also supplies special stands and indicating switches, together with the necessary auxiliary attachments.

Columbia Incandescent Lamp Company Secures Large Contract.

The Columbia Incandescent Lamp Company, St. Louis, Mo., has been awarded a contract by the United States Government for 270,000 incandescent lamps for use in the various Federal buildings, throughout the country, the various army posts and barracks, and the Congressional Library Building and the Public Printing Office in Washington. This is said to be the largest contract for incandescent lamps ever been placed by the Government.

Recent Additions to Traction Facilities of Harrisburg, Pa.

The Central Pennsylvania Traction Company, of Harrisburg, Pa., operating sixty-four miles of electric railways, began in January of last year the construction of its new power plant at Harrisburg, from which power was being furnished on the various lines under the company's control by the last of May. At that time



Power-House of the Central Pennsylvania Traction Company, Harrisburg, Pa.

the new station took the entire load and, as a result, three of the company's old stations which had hitherto been in use were abandoned. Owing to a large increase in the number of cars in operation and from alterations in the schedule, this station is now furnishing an average of sixty per cent more power than was required to operate the system a year ago.

The steam and electrical equipment in the power-house, which is one story in height, built of concrete, 175 feet by 102 feet, comprises three Reynolds horizontal, cross-compound, condensing Corliss engines, heavy duty type, built by the Allis-Chalmers Company, Milwaukee, Wis., each direct-connected to a 650-kilowatt, 600-volt, direct-current generator, also built by the Allis-Chalmers Company. These units have a capacity of fifty per cent overload for short periods, giving a maximum capacity for the entire plant of approximately 4,500 horse-power.

The main switchboard, consisting of twelve panels, is connected by a direct feeder line to each of the twelve sections into which the traction company's lines are divided.

An unusual and interesting feature of this plant is found in the means taken to furnish ample water supply directly from the Susquehanna river, which is some distance from the power-house. A five-foot tunnel has been bored in the solid rock thirty feet below the surface of the ground, extending from the plant in a direct line under the yards of the Central Iron and Steel Company to the river. From the river bank a thirty-six-foot iron pipe is extended to a point in the stream where the best quality of water is to be obtained. This water-supply tunnel is built and used jointly by the traction company and the Central Iron and Steel Company.

An Insulating Stud for Straight Electrical Work.

The insulating stud shown in the accompanying illustrations is made of but two metal parts, separated by a specially prepared, highly tenacious heat-resisting compound. The shank or threaded portion is made of a high-grade steel forging, while the base is of malleable iron. Fig. 1 shows the construction of the insulator, this representing a cross-section through the stud. As will be seen, the design is such that all stress or strain comes directly on the metal parts, thus insuring great strength and rigidity. The general appearance of the stud is shown in Fig. 2. The height is but one and three-eighths inches, while the four prongs of the base are designed to give ample room for other standard outlet bushings at the bottom of the outlet box. The stud is fastened by means of bolts or screws directly to the bottom of the box.

To demonstrate the high electrical resistance obtained in these studs, ten studs were sent to the Electrical Testing Laboratories, New York city, to be put to a high-potential test. All ten were first subjected to an alternating-current pressure of 4,000 volts for five minutes. Not

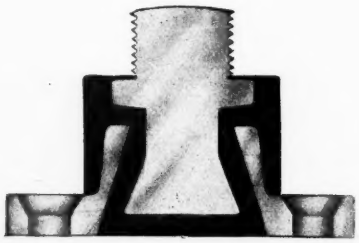


Fig. 1.—Cross-Section of Insulating Stud.

a single stud failed. After this the studs were tested for puncture by gradually raising the pressure. The puncture pressure varied, the lowest value being 5,400 volts, and the highest 10,500. After puncture, the insulation resistance was measured, and found to be so high that no ground was detected when using the voltmeter test.

The advantages claimed for this stud are the slight projection from the back of

Fig. 2.—General Appearance of Insulating Stud.

the box; and one device takes the place of both fixture stud and the old style insulating joint. These features bring about a considerable saving in time and labor, and the fact that the stud has four prongs at the base enables it to be securely attached to any outlet box. This stud is manufactured by the Thomas & Betts Company, 299 Broadway, New York city.

Navy Department Supplies.

The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids in Washington on August 6, 13 and 20 for electrical supplies for delivery at the different navy yards. Schedules can be obtained on application.

Current Electrical News

DOMESTIC AND EXPORT.

CHICAGO TELEPHONE COMPANY INCREASES CAPITAL—At a meeting of the directors of the Chicago Telephone Company, held July 15, it was decided to issue $4,000,000 of new capital stock, thus increasing the outstanding amount to $18,000,000. The company's authorized capitalization is $20,000,000.

NEW GEORGIA ELECTRIC LINE—A trolley line from Atlanta to Augusta, Ga., a distance of 160 miles, is planned. The company is known as the Atlanta & Carolina Construction Company, capitalized at $5,000,000. James W. English, Sr., of Atlanta, is president; Mathew Mason, vice-president, and M. T. Edgerton, secretary. Surveys have been completed between Atlanta and Conyers and between Athens and Augusta. It is said ground will be broken next October.

TO FURNISH POWER TO MINES—New York capitalists and Denver, Col., men, including W. C. Sterne, of the Arapahoe Electric Light Company, have organized the Hydro-Electric Company for the purpose of supplying power to the Argentine and Montezuma mining districts. They have bought out the Oro Grande pipe and ditch lines, which include over two miles of piping and four miles of ditch. Construction work will be commenced at once. Two thousand horsepower will be developed as soon as the plant is installed, and this will be increased to 7,000 later. The company was organized mainly for the benefit of the Pennsylvania mines, but power will be offered for sale throughout the entire region.

ELECTRIC LINE CHANGES HANDS—The Heims and others, acting through their recently organized company, the Joplin & Pittsburg Railway Company, have purchased the electric line of the Pittsburg Railway and Light Company, of Pittsburg, Kan. The line runs from Frontenac through Pittsburg to Columbus. An extension will be built from Scrammon on the main line toward Parsons. Other extensions may be shortly made. The new company has a capital of $5,000,000. The officers are: Joseph J. Heim, president; W. W. Calhoun, Carthage, Mo., vice-president; John A. Prescott, secretary and treasurer. The executive committee is: Mr. Heim, Mr. Prescott and J. W. Ground, of Carthage. Offices will be in the First National Bank Building, of Kansas City.

LONG ELECTRIC LINE PLANNED—A proposition has been launched at Minneapolis, Minn., to build an electric railway from Minneapolis to the Gulf of Mexico by way of Des Moines, Kansas City, Wichita, Oklahoma City, Dallas, Waco, Houston and Galveston. The company to build the line has been launched and capitalized at $50,000,000. The company is known as the Minneapolis, Kansas City & Gulf Railway Company, with headquarters at Minneapolis. The plan is to build a double-track railway, operated by electricity, through the cities mentioned above. Branch lines will be constructed connecting Omaha, St. Joseph, Lawrence and Topeka. The main line will run from Minneapolis and St. Paul direct to Des Moines. From there the line will go direct to Kansas City, and from there the main line will run by way of Ottawa to Wichita, whence it goes to Oklahoma City, passing through Guthrie. From Oklahoma City the line runs southeast to Dallas, and then south to Galveston, where it will connect with the gulf steamship lines. The stock of the company is in the hands of the Northwestern Securities Company, of Minneapolis, which is acting as the fiscal agent for the railway company. Heading the list of the board of directors is C. B. Holmes, a former president of the Chicago City Railway Company.

HUDSON RIVER ELECTRIC POWER COMPANY—The Hudson River Electric Power Company has made application to the up-state public service commission for consent to issue $3,232,000 bonds under a mortgage made mainly for refunding purposes in April last for $30,000,000. The company announces that it desires to spend the proceeds of the proposed issue at this time for the development of the water power of the Sacandaga river and the building of a large dam at Conklingville. It is stated in its application that the lands needed with flowage rights are estimated to cost $855,000; dam, canal and general power station at Conklingville, $802,000; steel tower transmission line to be constructed from Conklingville to Ballston with a connection to Spier Falls, thirty-three miles long, $371,000; transmission line from Amsterdam to Utica, sixty miles, $709,000; transmission line from Ballston to Schenectady, $191,000. These amounts, together with the expenditures for substations, switches, houses and the like will make the aggregate estimated cost of the improvements $3,265,276.45. It is stated that with a new dam at Conklingville the company could develop an average load at any hour any day in the year of at least 10,000 horse-power. Contracts have been entered into which call for 6,500 horse-power and there is sufficient market in the adjacent territory to take up the additional 3,500 horse-power.

CHICAGO TRACTION REORGANIZATION PLAN—The plan of reorganization proposed for the traction lines on the north and west sides of the city of Chicago, Ill., has been announced. It provides for the issuance of an unnamed amount of first mortgage gold bonds of a twenty-five-year period, the proceeds of which are to be used for the rehabilitation of the lines, and, in addition, a consolidated or second mortgage issue aggregating $32,800,000, and including $5,000,000 of twenty-year four per cent sinking fund income debentures, $4,500,000 five-year six per cent collateral notes, and an issue of ten-year five per cent collateral notes not to exceed $5,000,000, on which interest is payable only if earned after the payment of all fixed charges. The capital stock will be made the subject of an issue of income participation certificates bearing eight per cent, if that much is left after the payment of fixed charges. These receipts are divided into three classes, differing in priority of rights as to income and principal. These certificates total in nominal value $23,250,000, and will be distributed among the present stockholders in the ratio of their holdings. They are called Series A, B and C. The securities are to be issued in exchange for the existing bonds of the North Chicago and West Chicago Street Railway companies, and affiliated organizations, amounting to $37,800,000. It is learned that the First National Bank of Chicago has bought and sold about $4,000,000 of the rehabilitation bonds of the Chicago Union Traction five per cent bonds, brought out under the reorganization plan, approved by the committee and Judge Grosscup.

CHICAGO ELECTRIC MERGER—Plans for the consolidation of the Chicago Edison and the Commonwealth electric companies have been announced. They involve the formation of a new corporation with a capitalization of $30,000,000, to be known as the Commonwealth Edison Company, which will succeed to the business of the two big companies now controlling the franchise rights for the manufacture, sale and distribution of electric current for lighting and power purposes in Chicago, Ill. Resolutions have been passed increasing the capitalizations of the Chicago Edison and Commonwealth companies to $15,000,000 each. The new stock of the Edison company will be sold to stockholders of record August 31, 1907, at par in the ratio of 10.20 per cent of their present holdings, which is to be paid for in five instalments as follows: September 10, 1907, five per cent; November 1, 1907, twenty per cent; February 1, 1908, twenty-five per cent; May 1, 1908, twenty-five per cent, and August 1, 1908, twenty-five per cent. The full $15,000,000 of Chicago Edison stock is to be exchanged for stock in the Commonwealth Edison Company equally at par. The $15,000,000 of capital of the Commonwealth Electric Company is understood to have been pledged in whole or part by its holders as security for the payment of the gold mortgage bonds of the Edison company to the amount of $6,000,000 outstanding. An adequate amount of the new company's shares will be held in the treasury to secure the mortgage. The annual meeting of the Chicago Edison Company has been postponed until September 16, when the stockholders will vote on the merger proposition.

ELECTRIC RAILWAYS.

ALBANY, N. Y.—The new electric railway line constructed by the Delaware & Hudson Company between Ballston and Saratoga has been opened to the public.

SPRINGFIELD, ILL.—The DeKalb, Sycamore and Interurban Traction Company has certified to the secretary of state to an increase of capital stock from $100,000 to $1,500,000.

WILKES-BARRE, PA.—It is stated that officials of the Central Railroad Company are now considering a plan whereby the line between Wilkes-barre and Scranton may be electrified.

REDDING, CAL.—Redding is to have a double-track belt line electric railroad to go entirely around the city, with the necessary cross lines. Application has been made for the franchise by the Northern California Development Company.

NEW YORK, N. Y.—Permission to run electric cars in place of horse-drawn ones through First avenue and Twenty-eighth and Twenty-ninth streets has been granted to the Metropolitan Street Railway by Commissioner O'Brien of the Department of Water Supply, Gas and Electricity.

DALLAS, TEX.—E. H. R. Green, son of Mrs. Hetty Green, of New York, has decided to convert his Texas Midland Railroad, which runs 124 miles from Paris to Ennis, from steam to electrical operation by adopting the third rail. A branch is to be built from Greenville to Dallas, thirty miles. The road has no bonded debt.

OSHKOSH, WIS.—The Winnebago Traction Company, bonded for over $1,000,000, has passed into the hands of a receiver. R. H. Hackett, president of the company, has been appointed receiver. The motion for the receivership was made by the Trust Company of America, of New York. The head of the company is Emerson McMillin, of New York.

FREDERICK, MD.—The town council of Brunswick has granted a franchise for the use of certain streets of the town to the Brunswick & Middletown Railway Company. It is the intention of the company to build a trolley line from Brunswick to Middletown by way of the Maryland Tract, which will intersect the Frederick & Middletown line at Middletown.

BELLEFONTAINE, OHIO—Contracts have been awarded for the ballasting and laying the steel for the Lima-Bellefontaine traction line which is being built by the Indiana, Columbus & Eastern Traction Company, a part of the Schoepf syndicate. The contract has also been let for the concrete bridges and culverts and it is planned to have cars running by October 1.

ST. AUGUSTINE, FLA.—Word has been received here by the St. Johns Light and Power Company from the United States engineer's office in Jacksonville, to the effect that instructions have been received from the war department in Washington for the engineers in charge of this district to survey and lay out the right of way for the electric railway around the fort reservation.

CHAMPAIGN, ILL.—The first mortgage on the Springfield & Northern Traction Company's properties has just been filed with the county recorder of Logan county at Lincoln. This mortgage is given to the Central Trust Company of Illinois and is to secure the payment of $1,500,000 five per cent gold bonds. The bonds are of $1,000 denomination each and are made redeemable December 1, 1936. The building of the road will be carried on without delay.

BAR HARBOR, ME.—The Mount Desert Transit Company, an organization of prominent Bar Harbor summer residents, has bought of the Rodick estate, a tract of land for a railroad terminal. The company which consists of John S. Kennedy, of New York; George B. Dorr and Dr. Robert Amory, of Boston; Clement B. Newbold, of Philadelphia, and Fred. G. Lynam, of Bar Harbor, is formed to build an electric line.

NEW YORK, N. Y.—The New York & Queens County Railway Company, which is controlled by the Interborough-Metropolitan Company, and which operates trolley lines in Queens Borough, has announced that upon completion of the Blackwell's Island bridge its lines will carry passengers from points in Queens to Manhattan for a five-cent fare, This probably will include passage through the Belmont tunnel at Forty-second street.

SAN MATEO, CAL.—Professing to represent large eastern capitalists, two local residents have petitioned the board of trustees for a franchise to operate electric cars in the town and to Burlingame by means of the underground conduit system. Elaborate plans are displayed by the promoters, who refuse to divulge their backers. Peter Thorsen and John Johns, of the San Mateo Constructing and Contracting Company, are the petitioners and have styled the new traction company as the People's Railway Company.

MANKATO, MINN.—The syndicate of local capitalists that is to build the street railway line here has organized the Mankato Electric Traction Company, with W. L. Hixon, president; Fred Kron, vice-president; W. D. Willard, secretary and treasurer, and H. E. Hance, superintendent. An order for 300 tons of sixty-pound rails has been placed for delivery in thirty days. The line is to be built by a construction company of Chicago, which has lately completed the line at Wausau, Wis. The street railway company will incorporate in West Virginia.

WHEELING, W. VA.—Pittsburg, *via* Wheeling, to Columbus, Ohio, by trolley may be a reality in a comparatively short time. The Rapid Transit Company, a West Virginia corporation, which has as its head Albert Schenk, a millionaire meat packer, and its subsidiaries, the Wheeling Traction Company, and the Pittsburg Railways Company, are back of the movement. The routes and the principal points touched by the line will be Pittsburg, Carnegie, Hickory, Wheeling, Bellaire, Bethseda, Barnesville, Cambridge, Zanesville and Columbus. Promoter Schenk is authority for the statement that all preliminaries have been completed.

ATLANTIC CITY, N. J.—The Atlantic City & Shore Railroad Company has leased from the West Jersey & Seashore Railroad Company the entire electric railway service of Atlantic City, now operated by the Pennsylvania Railroad, extending from the Inlet to Longport, and including the auxiliary steamboat service between Longport and Ocean City and between Longport and Somers Point. The lease, which is for a term of twenty years, and dates from July 15, gives the Shore Line absolute control of the entire rapid transit system of Atlantic City and neighboring resorts. The Shore Line already operates its own electric railway service from Atlantic City along the mainland to Somers Point, and has built a trestle line across the thoroughfare from Somers Point to Ocean City. The rolling stock of the Atlantic City trolley service is being improved and new tracks are being laid.

BARRE, VT.—The annual meeting of the Barre & Montpelier Traction and Power Company, operating the trolley system between the two cities, was held at the company's office recently, resulting in the cutting down of the board of directors from seven to six and the removal of Frank G. Howland and Richard A. Hoar, of Barre, and Thomas E. Price, of Middlesex. Two Burlington men, A. O. Humphrey and J. J. Flynn, who recently disposed of the controlling interest in the corporation, also retire, being succeeded by Frank M. Corry, Edward H. Deavitt and I. M. Frost, of Montpelier, who acquired the stock formerly held in Burlington. These three, with D. M. Miles and H. K. Bush, of Barre, and T. J. Deavitt, of Montpelier, who were reelected, will control the road as directors. Frank M. Corry, who holds the largest amount of stock, was elected president; H. K. Bush, of Barre, vice-president, and Edward H. Deavitt, of Montpelier, secretary and treasurer; I. M. Frost, general manager; Fred H. Andrus, superintendent.

GREELEY, COLO.—Pledging to finance immediately and to begin building an electric road from Denver to Greeley within a month, E. A. Reacer, of the Interurban Construction Company, of Denver, is endeavoring to secure a franchise for such a road from the county commissioners. His company asks for a franchise over the county roads from the southern portion of Weld county to Greeley, a distance of fifty miles, and says it already has the consent of fifty per cent of those whose property abuts on the county roads for rights of way. In its petition the company asks for rights of way and a franchise for the construction, operation and maintenance of an electric railroad for the transportation of passengers and freight. The company says it has all concessions from Denver to the north portion of Adams county. A few weeks ago the Denver & Greeley Electric Railway Company, backed by Denver and Greeley business men, obtained a franchise in Weld county, and secured rights of way parallel to and between the Union Pacific and Colorado & Southern roads from Greeley to Denver. Another electric road company was incorporated some time ago, financed by St. Paul capital. The Greeley & Denver railroad people say their proposition is financed.

OBITUARY NOTES.

MR. NAUDAIN HAMILTON, president of the Union Electric Telephone and Telegraph Company, Moline, Ill., died on July 7, at Hot Springs, Ark., from the effects of an operation. Mr. Hamilton was forty-seven years of age, and a native of Harrisburg, Pa.

MR. MOSES DEPUY, aged sixty-seven years, died at his home in Port Jervis, N. Y., on July 16, of a complication of diseases. He organized the Port Jervis Telephone Company and was its president until his death. He was, for a number of years, village trustee and later president of the National Bank of Port Jervis. He is survived by his wife and two children.

PERSONAL MENTION.

MR. W. J. MITCHELL has been appointed acting manager of the Ithaca (N. Y.) office of the Bell Telephone Company.

MR. LAWRENCE WISEHART has been made acting manager of the Bell Telephone Company's Corning, N. Y., exchange, succeeding W. M. Hollenbeck, who resigned some time ago on account of ill health.

PROFESSOR GEORGE F. SEVER, of Columbia University, and consulting engineer of the Department of Electricity, Water and Gas of New York city, has been chosen to reorganize the electrical service of the New York police department.

MR. HOGE GILLIAM, erecting engineer with the Westinghouse Electric and Manufacturing Company at Philadelphia, Pa., has been made electrical superintendent of the New York, New Haven & Hartford Railroad Company, with headquarters at Stamford, Ct. Mr. Gilliam will have charge of operations on the electrified New York division of the road. C. L. Peterson becomes chief engineer of the Stamford power station; J. C. Welch, road foreman of electric locomotives, and D. E. Tyree, electrical inspector.

NEW INCORPORATIONS.

DOVER, DEL.—Esmeralda Power Company, Wilmington, Del. $400,000.

WACO, TEX.—Home Light and Power Company, Waco. $25,000. Incorporators: J. B. Earle, M. H. Lane, C. A. Boynton.

SPRINGFIELD, ILL.—Greenfield Light and Power Company. $7,500. Incorporators: H. C. Morrow, J. T. Calloway and C. R. Sheffield.

MORRISTOWN, N. J.—The Willsbrook Electric Light Company, Netcong. $30,000. Incorporators: J. S. Kennedy, H. H. Nelden, D. M. Cook, J A Staats and Elmer King.

BOSTON, MASS.—Berkshire Electric Company. To construct electric railways. $10,000. Incorporators: W. F. Waterman, Boston, and Joseph Lyons, North Adams.

DOVER, DEL.—Anglo-American Light Company. To furnish light, heat and power. $100,000. Incorporators: Jacob Veiger, Charles Veiger, Pittsburg, Pa.; Q. A. Stevens, Bellevue, Pa.

AUSTIN, TEX.—Texas Interurban Company. To build a system of interurban electric railways radiating out of Austin. $400,000. Stockholders: Thomas Moore, of Elizabeth, N. J.; Ephraim Miller, of White Plains, N. Y.; and Henry W. McKay, of Hempstead, L. I.

ATLANTA, GA.—The Tennessee & Georgia Interurban Railway Company. To run a line from Chattanooga, Tenn., into Walker county, Ga., to Rossville, thence to Chickamauga Park, thence to Catoosa Springs, a distance of twenty-five miles. $500,000. Incorporators: W. H. Payne, Jr., of Chattanooga; W. E. Mann, of Catoosa.

GUTHRIE, OKLA.—The Enid, Waukomis & Oklahoma City Interurban Railroad Company, of Waukomis. To build an interurban line one hundred miles in length from Enid to Oklahoma City, through the counties of Garfield, Kingfisher, Logan, Canadian and Oklahoma. $200,000. Stockholders: R. N. Brittan, president; J. A. Butler, treasurer; Charles Moore, secretary; Dr. F. S. Scott, A. H. Drew and J. B. Campbell, of Waukomis, and Valentine Johnson, of Enid.

SPRINGFIELD, ILL.—Charleston, Westfield, Marshall & Terre Haute Interurban Railway Company, of Marshall. To construct an interurban railroad from Charleston, Coles county, Ill., by way of Westfield, through the counties of Coles and Clark to the Indiana state line where it crosses the National road. $5,000. Incorporators and first board of directors: James Dawson, William B. Scholfield, Seymour Hurst, Norman Bennett, W. L. Biggs, M. L. Briscoe, W. R. Patten, T. M. Berkeley and E. T. Pinnell.

ELECTRICAL SECURITIES.

Despite the reaction which occurred at midweek, the recovery in prices during the last half was more rapid than the previous decline. Trading was largely professional, but the improved conditions during the latter part of the week resulted in some betterment as regards public buying. It now appears that the outlook is more encouraging than for some time for improved business and an easier money market. United States Steel earnings for the June quarter will be made public on July 30, and are expected to break all previous records. Railroad earnings continue to be remarkably good, and another feature which exerted a favorable influence was the placing of Amalgamated Copper on an eight per cent dividend basis. The latter move is thought to reflect the expectation for a renewal of the bull movement.

ELECTRICAL SECURITIES FOR THE WEEK ENDING JULY 20.

New York:	*Closing.*
Allis-Chalmers common	10½
Allis-Chalmers preferred	30
Brooklyn Rapid Transit	56¾
Consolidated Gas	119⅞
General Electric	140
Interborough-Metropolitan common	15⅛
Interborough-Metropolitan preferred	43
Kings County Electric	118
Mackay Companies (Postal Telegraph and Cables) common	70
Mackay Companies (Postal Telegraph and Cables) preferred	66¼
Manhattan Elevated	131⅞
Metropolitan Street Railway	85
New York & New Jersey Telephone	108
Western Union	80½
Westinghouse Manufacturing Company	146½

General Electric shows an advance of four points as compared with a week ago. This advance is held to be due to the favorable reception accorded its issue of $13,000,000 5 per cent convertible ten-year bonds. The company announces that the issue is a complete success.

Boston:	*Closing.*
American Telephone and Telegraph	108¼
Edison Electric Illuminating	212
Massachusetts Electric	57
New England Telephone	110
Western Telephone and Telegraph preferred	67½

Philadelphia:	*Closing.*
Electric Company of America	9¼
Electric Storage Battery common	51
Electric Storage Battery preferred	51
Philadelphia Electric	8½
Philadelphia Rapid Transit	22½
United Gas Improvement	91¼

At a special meeting of the Philadelphia Rapid Transit Company stockholders favorable action was taken on the proposal to ratify and approve the action of the directors and officers in executing and delivering a contract between the company and the city of Philadelphia as set out in the ordinance of councils approved July 1, 1907, and the amendment of the by-laws so as to provide for the election of three directors representing the city.

Chicago:	*Closing.*
Chicago Telephone	122½
Chicago Edison Light	144½
Metropolitan Elevated preferred	64
National Carbon common	71
National Carbon preferred	114
Union Traction common	—
Union Traction preferred	—

Directors of the Chicago Edison Company have declared the regular quarterly dividend of 2 per cent payable August 1. Books closed July 23 and reopen August 1.

National Carbon is said to be booked six months ahead. Its earnings are reported as being equivalent to about 7 per cent on the common stock this year.

South Side Elevated's Lake avenue extension will be open the latter part of September, instead of the middle of August as first expected. Traffic is holding its own as compared with a year ago, but not a month ago.

TELEPHONE AND TELEGRAPH.

NORTH STRATFORD, N. H.—The Coos Telephone Company is erecting an additional circuit south of this village.

GENEVA, N. Y.—The Empire State Telephone Company is placing a number of its wires in underground conduits.

HOUSTON, TEX.—An ordinance granting a franchise to the Automatic Telephone Company has been passed by the city council.

GARDEN CITY, KAN.—The Garden City Light, 'Phone and Manufacturing Company will erect a new building at a cost of $25,000.

DECATUR, ALA.—The Southern Bell Telephone Company is making a number of improvements to its lines in New Decatur, including the installation of new cables.

SEATTLE, WASH.—A. R. Reed, of Seattle, has applied to the city council at North Yakima, Wash., west of Spokane, for a fifty-year franchise to operate an independent telephone system.

MEMPHIS, TENN.—The Collierville Telephone Company has been formed with a capital of $5,000. The incorporators are: Sam Hinton, I. T. Ward, W. W. Norfleet, E. A. Johnson and H. Irby.

BRATTLEBORO, VT.—The Brattleboro exchange of the New England Telephone Company has been changed to the common battery system, and the capacity increased from 300 to 500 lines.

ATCHISON, KAN.—The Missouri & Kansas Telephone Company is preparing to place its wires underground, in accordance with the ordinance passed by the city council. The actual work will begin in the fall.

BARTON, VT.—At the meeting of the Barton Telephone Exchange Company it was voted to sell the local line to the Vermont People's Telephone Company, providing the committee could make proper arrangements.

COLFAX, WASH.—Members of the council of Colfax have agreed upon a fifteen-year franchise with the Pacific States Telephone Company for an annual tax of $250, payable in advance each year, the company to install and maintain, free of charge, a main-line instrument in the City Hall during the life of the franchise.

LINCOLN, NEB.—The University Place Telephone Company has been incorporated with an authorized capital of $25,000, divided into 250 shares of $100 each. The articles make it necessary for 200 shares of the stock to be subscribed and paid for before business is begun. The incorporators are residents of University Place.

WASHINGTON, D. C.—The Chesapeake & Potomac Telephone Company has placed in operation its new Lincoln exchange. The building was erected at a cost of $75,000, and the apparatus it houses cost in the neighborhood of $250,000. There are 3,200 subscribers connected, with an ultimate capacity of 20,000 telephones.

SAULT STE. MARIE, ONTARIO—The Clark wireless telegraph system is to be extended to the Soo. Contracts for electric power have been closed, and a station will shortly be in operation on the Michigan side. The system will be extended later to all the principal Lake Superior ports, including Duluth, Marquette, Port Arthur, Ashland and Superior.

ELY, NEV.—The Utah, Nevada & Idaho Telephone Company has acquired several telephone lines in the northeastern part of Nevada and is planning to construct a network of new lines over that part of the state. The company controls the Eureka and Ely line, the W. T. Smith lines in Elko county and another line in Idaho. It will build new lines connecting Salt Lake, Pioche, Austin and Tonopah with Ely.

SPOKANE, WASH.—The Home Telephone and Telegraph Company has begun construction work on its exchange for 10,000 instruments in Spokane. Six hundred thousand dollars will be expended on an exchange, substation and conduits. The foundation for the exchange at Howard street and Second avenue is being pushed, the purpose being to have the plant in operation before January 1, 1908. Eight conduits carrying 14,400 wires, which are individually insulated, have been laid. In addition to the police, fire and messenger service, the company will conduct a modern information department.

SPOKANE, WASH.—The Interstate Telephone Company has bought a site and will erect a structure at Palouse, Wash., to be used exclusively for telephone purposes. The company has absorbed the Interstate Cooperative Telephone Company, which has maintained an exchange for several years. It is taking over private lines and rural lines and extending them so that it will eventually have a network of wires covering eastern Washington and northern Idaho. Traffic arrangements have been made between the Interstate company and the Home Telephone Company, of Spokane. Seven rural lines centering at Palouse are connected with the Interstate central.

CHEYENNE, WYO.—Officers of the new Utah & Wyoming Telephone Company have made a contract with the Rocky Mountain Bell Telephone Company by which the new company will have connection with the Evanston exchange of the Bell company and will thus have the benefit of the local and long distance system of the Bell, says the Salt Lake *Herald*. The Utah & Wyoming Telephone Company has its headquarters at Randolph, Utah, and will connect Randolph, Woodruff, Laketown and Evanston. The company incorporated under the Utah laws with $10,000 capital. State Senator Wesley K. Walton is president and George Spencer is managing director of the company. It is owned by local capital and expects to install a first-class plant.

MENOMINEE FALLS, WIS.—The Menominee Falls Telephone Company has made extensive improvements and extensions to its lines within the last two months. New lines have been built to Templeton, connecting with the Lisbon and Merton lines; another line has been built to Germantown; still another branch extends to Fussville. A new switchboard is being placed in the local exchange. The company has for seven years past made connections with the lines of the Wisconsin Telephone Company, giving state and interstate service. Wires are now being strung on the extensions and telephones installed, and when completed, the local directory will include the names of nearly 300 local and rural subscribers. The company is incorporated. C. W. Fraser is president and J. A. Pratt, secretary and treasurer.

PROVIDENCE, R. I.—The increase of $500,000 in the capital stock of the Providence Telephone Company voted by the board of directors is made necessary to carry out the improvements in service required by the terms of the new agreement whereby the company received from the city council an exclusive franchise for six years, according to a statement made by Treasurer Charles T. Howard. The company will change all its four and six-party lines to two-party lines and will increase the number of calls on limited service from 500 to 600. To accomplish this it will be necessary to run a much larger number of wires to the several exchanges and to increase the working force, while the company will be required to make large expenditures of money. The last time the charter of the company was amended authority was given to increase the capital stock to $5,000,000 from time to time. The last increase was in 1904, at which time the issue stood at $1,600,000, the new issue being $400,000. Under the authority of the general assembly the directors have voted another increase of $500,000, the proceeds of which will be used for the purposes indicated. Under the provisions of the exclusive franchise which the city council has granted to the company the new schedule of rates is to go into effect on December 1 of this year. The company will not, Mr. Howard said, wait until that date for beginning reductions in its charges, but from time to time as facilities permit it will establish the new rates.

DATES AHEAD.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

Illuminating Engineering Society. Annual meeting, Boston, Mass., July 30-31.

International Association of Municipal Electricians. Norfolk, Va., August 7-9.

Ohio Electric Light Association. Annual meeting, Toledo, Ohio, August 20-22.

Michigan State Electrical Association. Battle Creek, Mich., August 20-22.

Canadian Electrical Exhibition. Montreal, Quebec, September 2-14.

Canadian Electrical Association Annual convention, Montreal, Quebec, September 11-13.

Colorado Light, Power and Railway Association. Annual convention, Denver, Colo., September 18-20.

Railway Signal Association. Annual meeting, Milwaukee, Wis., October 8-10.

ELECTRIC LIGHTING.

ATHENS, ALA.—The city is preparing to double the capacity of its electric light plant.

FORSYTHE, MONT.—It is announced that electric lights will be installed at Harlowton.

MARION, IND.—A number of improvements are to be made at the municipal lighting plant during the coming year.

TROY, N. Y.—The Halfmoon Light, Heat and Power Company, at its annual meeting reelected the board of directors.

BIG SPRINGS, TEX.—The electric light plant burned on July 11, and is a total loss. The plant was insured for $4,000.

CRYSTAL FALLS, MICH.—The council has been instructed to take steps for the enlargement of the electric light plant.

MAITLAND, MO.—The power-house of the Maitland Electric Light and Power Company was destroyed June 27, entailing a loss of $10,000.

MOUNT JOY, PA.—The Elizabethtown & Marietta Electric Light Company has accepted an ordinance granting it permission to enter Mount Joy.

MECHANICSVILLE, N. Y.—At the annual meeting of the Mechanicsville Electric Light and Gas Company the old board of directors was reelected.

NIAGARA FALLS, N. Y.—Plans have been perfected for the illumination of Niagara Falls. The General Electric Company will have charge of the work.

OGDEN, UTAH—An option has been secured by the city on the water rights of Willow creek, in Willard Canon, Box Elder county, in connection with the proposed municipal electric plant.

LAFAYETTE, IND.—The Merchants' Electric Light Company is preparing to spend $40,000 improving its plant. The company will also extend its heating mains to different parts of the city.

HAGERSTOWN, IND.—At a meeting of the city council Charles Werking was appointed to go to Pittsburg, Pa., to investigate the probable cost and best plan of lighting the town with electricity.

HUNTINGDON, PA.—A contract for electric lighting has been made with the Huntingdon Gas Company. The number of lamps to be furnished is seventy-five, and the city will pay $41.55 per lamp.

ST. LOUIS, MO.—The board of public improvements has plans under way for a municipal lighting and heating plant for the insane asylum and other buildings. The plant, it is estimated, will cost $150,000.

BOSTON, MASS.—The state board of gas and electric light commissioners has issued an order approving the consolidation of the Webster Electric Company and the Southbridge Gas and Electric Company.

BIRDSBORO, PA.—At a meeting of the town council the five-year contract for lighting the borough streets was awarded to the Birdsboro Electric Company. The terms of the contract are the same as the former one.

MOLINE, ILL.—The People's Power Company has given a $1,000,000 mortgage to the New York Trust Company to secure the payment of bonds issued for the purpose of carrying on extensive improvements in progress.

WHARTON, TEX.—H. P. Pheil, Sr., of Fredericksburg, and his son, H. P. Pheil, Jr., are looking into the matter of locating an electric plant at Wharton. They already have plants in operation at Fredericksburg and Giddings.

SAN DIEGO, CAL.—The county board of supervisors has awarded the South Coast Land Company a franchise for the erection of poles and wires for the transmission of electric light and power along certain county highways.

HUBBARD CITY, TEX.—The Union Central Light and Ice Company, of Hubbard City, will erect an electric plant for the supplying of current to the surrounding towns. The company has issued $25,000 six per cent bonds for the purpose.

TECUMSEH, NEB.—The electric light bonds, in the sum of $16,000, carried at the special election. The city will add $4,000 to the bonds and build a new lighting plant to cost $20,000. The bonds are to carry five per cent and run twenty years.

ABERDEEN, S. D.—The city council has adopted a report of a special committee, appointed to investigate a lighting proposition for Aberdeen, which favors granting a franchise to some private corporation willing to make an initial investment of $75,000.

PEORIA, ILL.—The Peoria Gas and Electric Light Company will shortly begin the work of placing its wires underground. About 30,000 duct feet will be installed this year, at a cost of $100,000. The cost for the entire work is estimated at $300,000.

SAN FRANCISCO, CAL.—The board of directors of the Pacific Gas and Electric Company, controlling the systems in California, has voted to levy an assessment of $3,000,000, or $10 a share, on the stock of its shareholders for rehabilitation and improvement purposes.

LAWRENCEBURG, TENN.—At a meeting of the city council final arrangements were made for installing electric lights and waterworks. The city has secured the J. S. Baxter place, two miles from town, and will erect an eight-foot dam, which it is estimated will furnish 225 horse-power.

SALT LAKE CITY, UTAH—The Utah Irrigation and Power Company, which will operate in Arizona, has filed articles of incorporation with the secretary of state. The capital stock is $1,000,000, with shares at a par value of $100 each. The headquarters of the concern will be at Phoenix.

PELLA, IOWA—The proposition to grant a twenty-year franchise to Z. G. Houck, of Dubuque, Iowa, to operate an electric light plant in Pella, and which was submitted to a vote, was defeated. A proposition will now be submitted for a municipal electric light plant and it is thought it will carry.

GARY, S. D.—By a vote of nearly two to one residents of this place decided in favor of the construction and operation of an electric lighting system, and for the completion of the municipal waterworks system, which is in the process of construction. Bonds to the amount of $4,500 were voted.

NORTH TONAWANDA, N. Y.—The common council has awarded a three-year contract to the Tonawanda Power Company for the lighting of this city at a cost of $57.50 per arc light per year, a reduction of $12.50 over the previous contract. For years, North Tonawanda has been paying seventy dollars and seventy-five dollars per arc light.

BALTIMORE, MD.—The contract for the erection of the addition to the Westport power-house of the Consolidated Gas, Electric Light and Power Company has been awarded to the Baltimore Ferro-Concrete Company. The improvement is to be of similar design to the present building and the construction will be of the same material—reinforced concrete. The addition, it is said, will cost about $170,000.

NORTH PLATTE, NEB.—At a special election held in this city to grant a franchise to the North Platte Electric Light and Power Company for a period of twenty years and to renew the contract with the North Platte Waterworks Company by granting a new franchise for twenty years with a renewal clause for the same term if not purchased by the city prior to that time, both propositions were defeated.

AMERICUS, GA.—William A. Dodson and associates, who have been granted valuable franchises for the establishment of an electric power plant and the building of a street railway in Americus, have financed their enterprises with Pennsylvania capitalists who subscribed the entire proposed bond issue. Two hundred thousand dollars is the capital stock and four Americus citizens are included in the directorate.

PASADENA, CAL.—An underground distributing system for the municipal electric lighting plant is proposed and Mayor Earley has been supplied with data and estimates which indicate that for an additional outlay of $72,744.15 the city can install conduits for electric light work in the fire district, which comprises the business section in general. The plant is now in full operation, the city's contract for lighting having expired on July 4.

BLOOMINGTON, ILL.—The light committee of the city council has awarded contracts for the machinery necessary to put the light plant in good condition. These aggregate $35,244.60. The

following companies were the successful bidders: Buckeye Engine Company, Salem, Ohio, to supply two engines, at $11,598; Western Electric Company, Chicago, Ill., two generators, at $7,869; Fort Wayne Electric Works, Fort Wayne, Ind., 4,000 lamps, regulators and transformers, at $13,227.60; Platt Iron Works, condenser, $2,550.

ALBANY, N. Y.—The first public hearings before the Public Service Commission in the second district were held July 15. Testimony was taken on the application of the Lockport Light, Heat and Power Company for authority to begin business with a capital of $600,000 and a bond issue for a like amount. The application was opposed by the city authorities on the ground that the new company proposes to merge the present lighting companies in Lockport and form a monopoly. Another hearing will be held in Lockport.

SUPERIOR, MICH.—The dam which the Great Northern Power Company has been constructing across Beaver river near the Macomber road is finished and the construction camp has been moved away. The dam is for the purpose of making a storage reservoir of Rice Lake, which is drained by the Beaver. The dam is of concrete and is about 800 feet long, twelve to fourteen feet high, fifty feet thick at the base and about twelve feet at the top. This reservoir will add about 3,000 acres to the system the power company is installing.

OCONTO, WIS.—The People's Land and Manufacturing Company has closed a contract with Perley Lowe, of Chicago, for the use of electric power to be transmitted from Peshtigo to Oconto, and the work of constructing the line will be begun immediately. The company has contracted for 750 horse-power, which will be furnished twenty-four hours each day, giving ample power to operate motors for several large factories besides that used for lighting the residences and business places of the city. Perley Lowe has recently completed a large concrete dam at Peshtigo.

COVINGTON, KY.—It is reported that the Bibb Power Company has purchased about 8,000 acres at Stewart, twelve miles south of Covington, paying $25,000 for the property. It is also reported that the Bibb company has closed a deal for White's Shoals on Alcovey river in the state of Georgia, paying therefor the sum of $15,000. This is said to be one of the finest waterfalls in middle Georgia. It is the purpose of the company to use the power generated from this source in the operation of an electric railway between Jackson and Social Circle, passing through the eastern section of Newton county.

BATH, N. Y.—The board of village trustees has abandoned the idea of municipal ownership of the electric light plant, and has completed a contract to be entered into by the Bath Electric Light Company upon expiration of the present lighting contract in September. The contract as drawn up calls for seventy-five arc lights, an increase of three over the present number; also for ten incandescent lights of twenty-five candle-power, together with two lights at the fire company's building. Under the old contract the maximum price for commercial lighting was eighteen cents per kilowatt-hour, whereas under the new contract this is reduced to fifteen cents. The service will cost the village $5,000 a year.

NEWARK, N. J.—The finance committee of the common council has set aside $30,000 for the installation of a municipal electric plant for the new city hall. By unanimous vote the aldermen adopted a resolution providing that the question of a municipal electric lighting plant to light the city should be submitted to the people at the general election next November. The law known as the Jones act, approved July 5, 1906, provides that a proposition for a municipal light, heat or power plant may be submitted to the voters of any city at a general or special election. In accordance with this law and the resolution passed, the ballots next November will contain a paragraph outlining the city's plan to spend not more than $1,000,000 for a street lighting plant.

NEW HAVEN, CT.—Announcement is made that the United Illuminating Company is to put out $200,000 worth of the stock issue of $500,000 recently authorized. At a meeting of the stockholders of the United Illuminating Company, held March 20, 1907, the amount of the capital stock of the company was increased from $1,000,000 to the sum of $1,500,000, and the directors were authorized to issue the same, at such times and in such amounts as should seem to them to be for the best interests of the company. To provide funds to pay for the cost of the underground conduits, now under construction, the directors of the company now offer to stockholders 2,000 shares of capital stock of the company, at the rate of one share of new stock for each five shares of old stock now held.

AUGUSTA, GA.—The street-lighting committee of city council has renewed, for a period of four years and three months, the lighting contract between the city of Augusta and the Augusta Railway and Electric Company, and will pay for each light the same amount as in the past, sixty-eight dollars per annum. The present contract expires in August. The exact length of the renewal contract was determined by the fact that in four years and three months the time-limit for placing all wires underground by order of the city will have been reached. By that time the city will have taken some definite action on the question of the advisability of building a municipal lighting plant, and it is also probable that the Anthony Shoals Power Company will be in the field. There are at present about 385 lights in use, which makes a total cost of $28,000.

ALBANY, N. Y.—Before passing out of existence the state commission on gas and electricity on June 29 reduced the price of gas and electricity in four localities and acted upon a number of important applications. The commission reduced the price of gas in Buffalo from $1 to ninety-five cents a thousand; gas in Saratoga from $2 with twenty-five per cent discount to $1.45, electricity from twelve and one-half cents a kilowatt-hour to eight cents; electricity in Mount Vernon from twenty cents a kilowatt-hour to thirteen cents; electricity in Orangetown, Rockland county, from twenty cents to fifteen cents. In the matter of the application of the Utica Gas and Electric Company, consent was given to the issuance of five per cent refunding fifty-year gold bonds to the amount of $2,000,000 for meeting betterments heretofore incurred and in process of making upon the plant of the Utica company and its subsidiary companies. The application of the Oriskany Hydro-Electric Company, proposing to operate in the counties of Oneida, Madison and Chenango, for a certificate of authority to transact business and for consent to issue first mortgage five per cent forty-year gold bonds was granted. The company asked for consent to the issuance of bonds to the amount of $400,000. The application of the village of Potsdam for a certificate of authority to establish and operate an electric lighting system for commercial purposes was denied. The taxpayers of the village at a special election held April 30, 1907, voted in favor of the proposition at an expense not to exceed $22,000. The population of the village is about 6,000, which the commission considered not large enough to support two plants, the territory already being supplied with an ample and well-constructed system furnishing at reasonable rates the service which the municipality proposed to furnish.

NEW PUBLICATIONS.

COOPER MEDICAL COLLEGE—The Cooper Medical College, San Francisco, Cal., has issued its annual announcement for the year 1907-1908.

YEAR BOOK OF THE MODERN SCIENCE CLUB—The Modern Science Club, of New York, has issued its annual year book, "The Engineers' List," for the year 1907. This contains a number of interesting articles, among them being one entitled "The Internal Combustion Engine—Its Principles and Uses," by J. R. Bibbins; one on "Does the Long-Stroke Corliss Best Fulfil Modern Requirements?" by B. F. Allen, and an article by J. A. Donnally on "Comparison of Formulas of Flow of Water, Steam, and Other Gases."

REPORT OF THE COMMISSIONER OF EDUCATION—The annual report of the Commissioner of Education of the Department of the Interior, Washington, D. C., for the year 1905 has been issued. This, in addition to the usual statistics, contains a number of reports on educational conditions in foreign countries. It also gives a report of the Mosely Educational Commission, prepared by W. T. Harris, which visited the United States the latter part of the year 1903. The report contains also statements of the proceedings instituted to execute the Rhodes scholarship trust. The educational situation in France is discussed, as well as the higher education provided for men in the United States and Germany; several chapters of the report are devoted to the establishment of the American system of education in Porto Rico and the Philippines; a complete list of the universities, colleges and technical schools, giving the courses offered at each, is also included.

INDUSTRIAL ITEMS.

THE JEFFREY MANUFACTURING COMPANY, Columbus, Ohio, is distributing a postal card showing an illustration of a Jeffrey drill installed in a South African mine.

THE ELECTRIC GOODS MANUFACTURING COMPANY, Boston, Mass., in connection with Old Home Week, is distributing a large advertising card calling attention to its products.

THE KEYSTONE ELECTRICAL INSTRUMENT COMPANY, Philadelphia, Pa., announces that it will hereafter be represented in Chicago, Ill., by the Minerallac Company, 839 Monadnock Block.

THE DU BOIS IRON WORKS, Du Bois, Pa., is sending out a folder calling attention to the Du Bois gas engine. This engine is built in sizes from five to 300-horse-power, for general power and lighting service.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, is distributing bulletin No. 102, describing and illustrating its high-speed magnetic control end cell switch for use in connection with Chloride Accumulator installations.

THE FEDERAL ELECTRIC COMPANY, Chicago, Ill., has ready for distribution a loose-leaf catalogue descriptive of electric signs, the lighting clusters manufactured by the company, Federal clamp sockets, bushings, receptacles and other lighting accessories. This the company will be pleased to furnish upon request.

THE HOLTZER-CABOT ELECTRIC COMPANY, Brookline, Mass., is sending out the following bulletins: No. 153A (displacing No. 13) descriptive of testing magnetos; No. 154 (displacing No. 147) describing automatic electric gas lighting apparatus; No. 204, describing linemen's portable telephone testing sets.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., has prepared circular No. 1,092, descriptive and illustrative of the Westinghouse multiple alternating arc lamp. The lamp is of a new design, and is said to embody a number of features which add materially to its regulation, durability and convenience in manipulation.

THE BRYANT ELECTRIC COMPANY, Bridgeport, Ct., is distributing a very complete catalogue describing and illustrating the electrical supplies it manufactures. These include sockets, receptacles, rosettes, switches, cutouts, fuses, and attachment plugs. The catalogue is substantially bound in boards, and is replete with excellent illustrations and descriptive information, including a new price list. There is also a code and code index to facilitate the ordering and shipment of goods.

THE BUFFALO STEAM PUMP COMPANY, Buffalo, N. Y., is distributing its new pump catalogue. The first section is devoted to descriptions and illustrations of steam and power pumps, and the second section to centrifugal and turbine pumps for high or low lifts, and the various types of drive—pulley, engine and motor. The catalogue is of standard size—six by nine inches—and is well gotten up, the majority of the cuts shown not having before appeared in the company's advertising literature.

THE AMERICAN INSTRUMENT COMPANY, Philadelphia, Pa., is mailing a card which bears an illustration of the American standard voltmeter. The company states that these instruments are so accurately calibrated that it can guarantee their correctness within one-fifth of one per cent. This high accuracy is particularly valuable in conjunction with the unusually long scales, which allow readings to be made with a marked degree of precision. The company will be pleased to send its latest catalogue to any one interested upon request.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., is distributing a new series of bulletins, as follows: No. 4,506, describing and illustrating the Edison Gem filament fifty-watt lamp; No. 4,512 (superseding flyer No. 2,188) describing and illustrating manhole fuse boxes, types MD and Tailleur; No. 4,516, MR circuit-breakers; No. 4,518 (superseding bulletin No. 4,412) descriptive of electric hoists; No. 4,520, engine-type continuous-current generators, form R; and a supplement to bulletin No. 4,495 which describes General Electric direct-current fan motors, type DL.

THE WARREN ELECTRIC MANUFACTURING COMPANY, Sandusky, Ohio, in bulletin No. 30, illustrates and describes the Warren revolving-field alternator, which is made for generating single-phase, two-phase, or three-phase currents. Owing to the spacing of the coil slots, a customer who purchases, for example, a single-phase, eighty-five-kilowatt alternator can at any time convert it into a 100-kilowatt, two-phase or three-phase machine, by merely changing the armature coils. Machines of 100 kilowatts, 200 kilowatts and 300 kilowatts, sixty cycles, are illustrated, one of the latter in the Bay City, Mich., municipal electric light station, being shown.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has closed a contract with the town of Little Valley, N. Y., for a new electric lighting equipment. There are included in the contract an Allis-Chalmers 150-kilowatt, sixty-cycle 1,100-volt alternator; an eight-kilowatt, 120-volt direct-connected exciter and an eighteen-inch by forty-two-inch Allis-Chalmers Corliss engine of 250 horse-power, heavy-duty type. The new engine runs at a comparatively low speed of eighty revolutions per minute as against the 265 revolutions per minute of the units which were formerly in use. The fly-wheel alone weighs 14,000 pounds, and the new equipment will readily carry a load of 4,000 incandescent lamps and twenty-five arcs.

NEW MANUFACTURING COMPANIES.

SPRING LAKE, N. J.—The Euelectric Company has been incorporated to manufacture electrical appliances. The capital is $100,000, and the incorporators are: F. C. Warrell, Lansdowne, Pa.; J. D. Kirkbride, Spring Lake, and C. Wilson, Philadelphia, Pa.

PORTLAND, ME.—The Electric Development and Construction Company has been incorporated for the purpose of manufacturing and dealing in storage batteries. The capital stock is $1,000,000, and the officers are: president, James E. Manter, of Portland; treasurer, Clarence E. Eaton, of Portland.

ALBANY, N. Y.—The Yetman Typewriter-Transmitter Company, of New York city, formed to manufacture transmitting typewriters, telegraph transmitters, automatic telegraph machines, etc., has filed articles of incorporation. It is capitalized at $1,500,000. The directors include: Samuel Johnston, Charles E. Yetman, William M. Williams and Gabriel Morton, of New York, and James J. Stevenson, of Oshkosh, Wis.

NEW ALBANY, IND.—The Southern Indiana Electric Company has filed articles of association at New Albany, the incorporators being: Charles D. Knoefel and Frank Beaucond, of New Albany; Robert S. Donaldson and Philip S. Pogue, of Louisville, Ky. The capital stock is fixed at $5,000. New Albany will be the headquarters of the company, and it is the intention to engage in the manufacture of electrical appliances, among which will be a terminal box, the invention of Frank Beaucond, of New Albany.

Record of Electrical Patents.

Week of July 16.

859,909. TELEPHONE ATTACHMENT. Arne H. Berg, Clarkfield, Minn. A mechanically operated signal.

859,923. ELECTRICAL CONDENSER. Clarence Z. Davis, Buffalo, N. Y., assignor to Cyphers Incubator Company, Buffalo, N. Y. Alternate sheets of metal foil and insulating material are rolled up into cylindrical form.

859,948. TELEGRAPHY. Isidor Kitsee, Philadelphia, Pa. Employs a chemical writer.

859,949. TELEGRAPHY. Isidor Kitsee, Philadelphia, Pa. Utilizes a siphon recorder.

859,950. SYSTEM FOR AUTOMATIC SIGNALING. Isidor Kitsee, Philadelphia, Pa. A block signal system.

859,993. TELEGRAPH OR ELECTRIC WIRE POLE. Samuel H. Summerscales, Winnipeg, Manitoba, Canada. A built-up steel pole.

859,998. METHOD OF ELECTRICAL SEPARATION. Henry A. Wentworth, Lynn, Mass., assignor to Huff Electrostatic Separator Company, Boston, Mass. An electrostatic separator.

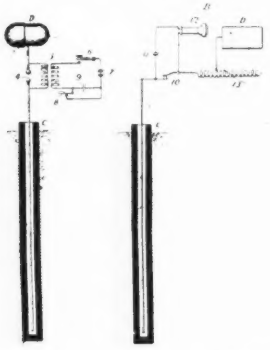
860,001. SHIP'S TELEGRAPHY. Richard D. White, Washington, D. C. A house system for ships.

860,016. SUBSTATION PROTECTOR. Frank B. Cook, Chicago, Ill. An insulator supporting an inclosed fuse.

860,025. GUARD FOR THE MOUTHPIECES OF TELEPHONE TRANSMITTERS. Gerhardt E. Grimm, Philadelphia, Pa. A holder for paper guards.

860,036. ELECTRIC-ARC HEADLIGHT. John Kirby, Jr., Dayton, Ohio, assignor to United States Headlight Company, Buffalo, N. Y. An arc lamp held within a reflector.

860,044. TELEPHONE ATTACHMENT. Edward S. Maddock, Chicago, Ill. A device for holding coins.



860,051.—CONSTRUCTING ANTENNÆ OF WIRELESS TELEGRAPHY.

860,046. MACHINE-OPERATING MECHANISM. Charles R. Meston, St. Louis, Mo., assignor to the Emerson Electric Manufacturing Company, St. Louis, Mo. A clutch and gear.

860,051. CONSTRUCTING ANTENNÆ OF WIRELESS TELEGRAPHY. Joseph Murgas, Wilkes-Barre, Pa. The antennæ is extended into the earth and insulated from it.

860,059. ELECTRIC-LIGHT BRACKET. Louis Rémond, Grand Rapids, Mich., administrator of Gustave Gautier, deceased, assignor to Grand Rapids Show Case Company, Grand Rapids, Mich. A pivoted tubular arm.

860,089. ELECTRIC-LAMP BRACKET. Frederick H. Löhrs, Elizabeth, N. J. An adjustable stand.

860,104. AUTOMATIC STARTER FOR ELECTRIC MOTORS. William C. O'Brien, Baltimore, Md., assignor to Monitor Manufacturing Company, Baltimore, Md. A starter operated by a solenoid.

860,114. TROLLEY HARP. Charles E. Atkins, Richmond, Ind., assignor of one-third to John M. Long, and one-third to Alexander Gordon, Richmond, Ind. A removable harp.

860,117. BASE-FASTENING DEVICE FOR ELECTRICAL APPARATUS. Louis Bates, Hoboken, N. J.; Mamie Sidman Bates administratrix of said Louis Bates, deceased. The holding nuts are embedded within the base.

860,195.—STORAGE-BATTERY ELECTRODE.

860,153. LAMP SOCKET. Robert Rowley, New York, N. Y. The key is controlled by an electromagnet.

860,157. LIGHTNING ARRESTING SWITCH. Washington D. Shirk, Fairfield, Iowa. A switch for cutting out lightning arresters.

860,173. FLOTATION BEARING. Otis White, Springfield, Ill,, assignor to Sangamo Electric Company, Springfield, Ill. The rotating element is supported on a liquid.

860,175. TELEPHONE SYSTEM. David H. Wilson, Chicago, Ill. assignor to George W. Kretzinger, Chicago, Ill. A bridge circuit is associated with each instrument.

860,179. ELECTRIC HEATER. Edward H. Abbott, Los Angeles, Cal. A resistance heater.

860,195. STORAGE-BATTERY ELECTRODE. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to Edison Storage Battery Company, West Orange, N. J. The active element is inclosed within corrugated tubes.

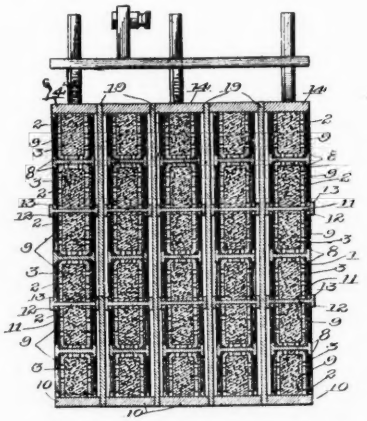
860,291. STORAGE BATTERY. William Gardiner, Chicago, Ill., assignor to C. P. Stringfield, Chicago, Ill. The active material is contained within a metallic foraminous holder.

860,305. ELECTRIC CURRENT REGULATOR. David R. Knapp, Philadelphia, and Howard E. Cade, Pencoyd, Pa. A regulator for charging storage batteries.

860,325. LAMP HOLDER. William J. Phelps, Detroit, Mich. A holder for turn-down incandescent lamps.

860,360. PLUG-SWITCH. Earl C. Eldredge, Springfield, Mass. A locking plug-switch.

860,477. METHOD OF AND MEANS FOR CHARGING ELECTRIC FURNACES. William H. Huffman, Niagara Falls, N. Y., assignor to International Acheson Graphite Company, Niagara Falls, N. Y. The material to be treated is held between flexible walls.



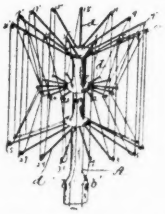
860,291.—STORAGE BATTERY.

860,482. CONTACT-PLUG FOR SOCKETS FOR ELECTRIC LIGHTS. Frederick W. Jaeger and Gustav A. Landsee, Milwaukee, Wis. A contact-plug with screw-threaded members.

860,526. TROLLEY-WIRE HANGER. Walter G. Clark, New York, N. Y., assignor to Clark Electric Manufacturing Company, New York, N. Y. A hanger for catenary suspension.

860,561. ART OF RAILWAY SIGNALING. Wesley T. Oviatt, Stratford, and Edward F. Latimer and William Grunow, Jr., Bridgeport, Ct. Signals are provided at each end of each section.

860,568. ELECTRIC INCANDESCENT LAMP AND CONNECTION THEREFOR. William J. Phelps, Detroit, Mich., assignor to the Phelps Company, Detroit, Mich. A turn-down lamp.



860,601.—ARRANGEMENT OF THE FILAMENT FOR HIGH-VOLTAGE INCANDESCENT ELECTRIC LAMPS OF HIGH EFFICIENCY.

860,572. MEANS FOR CONTROLLING ELECTRIC-CURRENT-DISTRIBUTING SYSTEM. Joseph L. Routin, Lyons, France. A regulator controlling both the speed and the potential.

860,587. ELECTRIC FURNACE. Ross C. Unger, Cleveland, Ohio. The resisting element is granular.

860,601. ARRANGEMENT OF THE FILAMENT FOR HIGH-VOLTAGE INCANDESCENT ELECTRIC LAMPS OF HIGH EFFICIENCY. Carl Glogau, Stuttgart, Germany. The filament is wound continuously and spirally over supporting points.

860,605. FIRE-PROTECTION SYSTEM. James G. Nolen, Chicago, Ill., assignor, by mesne assignments, to Automatic Fire Protection Company. A time-switch is associated with the protective system.

860,606. SAFETY FUSE. Franz Oprendek, Vienna, Austria-Hungary, assignor, by mesne assignments, of one-half to Samu Pollak, Gyor, Austria-Hungary. The fuse cord is wound upon spools.